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# PROJECT PLAN

**for the**

## VASQUEZ BOULEVARD & I-70 SITE
## DENVER, CO

## PHASE III FIELD INVESTIGATION

June 30, 1999

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# APPROVAL PAGE

This Project Plan for the Vasquez Boulevard and I-70 Site - Phase III Field Investigation has been prepared at the request of the U.S. Environmental Protection Agency, Region 8, by ISSI Consulting Group, Inc. Study investigations and activities addressed in this Project Plan are approved without condition.

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# TABLE OF ABBREVIATIONS

| | |
|---|---|
| ATSDR | Agency for Toxic Substances and Disease Registry |
| CAR | Corrective Action Request |
| CCOD | City and County of Denver |
| CDPHE | Colorado Department of Public Health and Environment |
| CLP | Contract Laboratory Program |
| COC | Chain of Custody |
| COPC | Chemical of Potential Concern |
| DCN | Document Control Number |
| DMP | Data Management Plan |
| DQA | Data Quality Assessment |
| DQOs | Data Quality Objectives |
| FPL | Field Project Leader |
| FQAC | Field Quality Assurance Coordinator |
| FSP | Field Sampling Plan |
| GFAA | Graphite Furnace Atomic Absorption |
| GLP | Good Laboratory Practices |
| HASP | Health and Safety Plan |
| HAZWOPER | Hazardous Waste Operations and Emergency Responder |
| HSO | Health and Safety Officer |
| ICP-MS | Inductively Coupled Plasma-Mass Spectrometry |
| IDL | Instrument Detection Limit |
| IDW | Investigation Derived Waste |
| IEUBK | Integrated Exposure Uptake Biokinetic Model |
| ISSI | ISSI Consulting Group, Inc. |
| LCS | Laboratory Control Sample |
| MDL | Method Detection Limit |
| MK | Morrison Knudsen Corporation |
| NIST | National Institute of Standards and Technology |
| OSHA | Occupational Safety & Health Administration |
| PARCC | Precision, Accuracy, Representativeness, Completeness and Comparability |
| PDC | Property Data Center, Inc. |
| PE | Performance Evaluation |
| QAPP | Quality Assurance Project Plan |
| QA/QC | Quality Assurance/Quality Control |
| RBC | Risk-Based Concentration |
| REAC | Response Engineering and Analytical Contract |
| RME | Reasonable Maximum Exposure |
| RPD | Relative Percent Difference |

| | |
|---|---|
| RPM | Remedial Project Manager |
| SOPs | Standard Operating Procedures |
| START | Superfund Technical Assessment and Response Team |
| UCL | Upper Confidence Limit |
| USEPA | U.S. Environmental Protection Agency |
| VBI70 | Vasquez Boulevard and Interstate 70 |
| XRF | X-ray Fluorescence |

# 1.0 BACKGROUND AND STUDY OBJECTIVES

The U.S. Environmental Protection Agency (USEPA), Region 8, is working in cooperation with the City and County of Denver (CCOD), the Colorado Department of Public Health and Environment (CDPHE), the Agency for Toxic Substances Disease Registry (ATSDR), and representatives of several citizens groups to investigate and remediate environmental contamination that has been discovered at the Vasquez Boulevard and Interstate 70 (VBI70) site, located in Denver, Colorado.

Although substantial data regarding the nature and extent of contamination have been collected at the site (see Section 1.2, below), additional data are required to support reliable risk assessment and remedial risk management decisions. These additional data will be collected during a set of field activities that are referred to as the Phase III Field Investigation. This project plan presents the data quality objectives for the Phase III activities, along with the sampling and analysis design, rationale, and specific quality assurance and quality control activities needed to achieve those data quality objectives.

## 1.1 Key Personnel

The following key USEPA personnel will serve as contacts and provide technical expertise during implementation of this project plan.

- Bonita Lavelle, USEPA Remedial Project Manager. Ms. Lavelle will be responsible for overall project management, technical oversight and coordination among USEPA and its contractors, the State of Colorado and the City and County of Denver. Ms. Lavelle will be a principal decision-maker for this project.

- Christopher P. Weis Ph.D., USEPA Regional Toxicologist. Dr. Weis will serve as the primary technical contact for this project. He will be responsible for technical oversight and evaluating the human health risk to residents of the VBI70 site. Dr. Weis will be a principal data user and decision-maker for this project.

- Tony Selle, USEPA Data Management and GIS Mapping Specialist. Mr. Selle will provide oversight of data management and GIS mapping activities associated with the Phase III project.

- Ted Fellman, USEPA Community Involvement Specialist. Mr. Fellman will provide community involvement support for all aspects of the VBI70 Phase III field investigation.

Several USEPA contractors will provide technical support to the key USEPA personnel. Figure

1-1 is an organizational chart outlining the key USEPA personnel and its contractors who will participate in operations planned for development, implementation, oversight and interpretation of data generated from the Phase III field investigation.

## 1.2 Project Background

The VBI70 site is located in the northern section of Denver, Colorado. The study area is bounded on the west by the South Platte River and is approximately bounded on the east by Colorado Boulevard. Northern and southern boundaries for the study area are East 56th Avenue and East 35th Avenue, respectively. A small area south of Globeville is also included. Its boundaries are: Interstate 70 on the north, 35th Avenue on the south, Huron Street to the west, the South Platte River on the east and the Burlington Northern Railroad on the southeast. Refer to Figure 1-2 for a map of the site boundaries. The VBI70 site is comprised mainly of residential neighborhoods, but also includes some areas used for commercial and industrial purposes. Contained within the site boundary are two historic smelters (Omaha-Grant and Argo) and one current smelter (Globe).

Investigations begun in the vicinity of the Globe Smelter revealed the presence of residential soil contamination with metals associated with historic operations of the smelter. As sampling activities were extended further from the smelter, a number of residential properties with elevated levels of metals in yard soil were identified. The discovery of these elevated soil levels in residential areas is the basis for establishing the VBI70 site.

A number of investigations have been performed to date at the site, as summarized below:

Table 1-1 Past and Proposed Investigations for the VBI70 Site

| Title | Description | Dates of Implementation | Reference |
|---|---|---|---|
| Phase 1 | Approximately 2500 grab samples from 1200 properties | Spring 1998 | UOS 1998a |
| Phase 2 | Surface soil grab samples from 300 additional properties | Summer 1998 | UOS 1998b |
| Removal action | Two 5-point composite samples from 44 properties | Summer/Fall 1998 | UOS 1998b |
| Physico-chemical Characterization of Soils | Comparison of sieved and un-sieved soils;<br>Speciation of arsenic and lead; | Summer 1998 | 1998a |
| Risk-based sampling | High density surface sampling at 8 properties;<br>Relationship between soil and dust;<br>Garden vegetable data | Summer/Fall 1998 | ISSI 1999b |
| Pilot Scale Soil Characterization Study | Comparison of chemical and physical characteristics of site soils with proposed source soils and materials | Projected for Summer 1999 | ISSI 1999d |

Key findings and conclusions from these studies are summarized below:

- The chemicals of principal human health concern are arsenic and lead (see Appendix A).
- The spatial pattern of contaminated properties across neighborhoods appears to be unpredictable, with impacted yards occurring at widely separated locations, often surrounded by non-impacted properties (UOS 1998a, 1998b; see map in Appendix B).

- Within a property that has elevated levels of arsenic, the pattern of contamination is generally wide-spread (covering most of the yard), but concentrations may vary significantly from place to place (ISSI 1999b).

- Contamination is generally highest the surface, diminishing at depths of 12-24 inches (ISSI 1999b, 1999c [see Appendix C]).

- The chemical form of the arsenic is arsenic trioxide (ISSI 1998b).

Based on these data, USEPA has concluded that concentrations of arsenic and, to a lesser extent, lead in surface soil may be of health concern to some (but not all) area residents. Because of this concern, USEPA proposed this site for inclusion on the National Priorities List in January, 1999.

## 1.3 Study Objectives

USEPA's overall objective is to collect sufficient data to adequately characterize the nature and extent of soil contamination at this site, and to support reliable risk assessment calculations and risk management decisions at the site regarding the need to remediate residential soil. Phase III comprises a set of field activities that specifically targets four data gaps associated with exposure of residents to contaminated soil:

1. Location of Residences with Contaminated Soil

Because of the apparent lack of spatial pattern in the location of contaminated residences, a yard-by-yard sampling effort is required to locate and identify all properties with elevated levels of arsenic and lead. Thus, the principal study objective of this project is:

> ***Collect sufficient soil data from each residential property within the site boundaries to support reliable exposure and risk calculations at each property, including an evaluation of both short-term and long-term risks.***

2. Relation Between Contaminant Levels in Residential Yard Soil and Indoor Dust

Contaminants in outdoor soil are able to enter homes through airborne and direct transport pathways, and can contribute to contamination of indoor dust on floors, tables, counter tops, etc. Data collected to date suggest that indoor dust contamination at residences may not be extensive at this site (ISSI 1999b), but the data are too limited to draw firm conclusions regarding the importance of the soil-to-dust contaminant transport. Consequently, the objective of this component of the Phase III project is to:

> ***Collect sufficient numbers of paired soil-dust samples to reliably quantify the average relationship between outdoor yard soil contamination and indoor dust contamination in area residences.***

3. Characterization of Soil in Alleyways

Unpaved alleyways exist at some locations in the study area. If the soil in these alleyways is contaminated with arsenic and/or lead, this could be a source of concern for nearby residents. Currently, no data exist on contaminant levels in alleyways within the study area. Therefore, the objective of this part of the Phase III program is to:

> ***Collect sufficient samples from selected unpaved alleyways to determine whether levels of arsenic and/or lead in alleyway soil are likely to be of potential health concern to area residents, and if so, to provide initial information that will help determine the likely source and spatial pattern of alleyway contamination.***

4. Characterization of Soil at Schools and Parks

Area children are likely to be exposed not only at their residences but also at neighborhood schools and parks. Available data (UOS 1998a, 1998b) suggest that contamination at these locations is not of concern, but not all locations have been sampled. Therefore, the objective of this component of the Phase III project is to:

> ***Collect sufficient samples of surface soil from un-tested schools and parks to support reliable exposure and risk calculations at each location, including an evaluation of both short-term and long-term risks.***

## 1.4 Project Description

These objectives will be accomplished by collection of environmental samples during field work to be completed in the summer of 1999. This work will be performed by Morrison Knudsen Corporation (MK), with planning and oversight provided by ISSI Consulting Group, Inc. (ISSI). All work will be conducted in accord with the detailed specifications contained within this project plan.

# 2.0 DATA QUALITY OBJECTIVES AND STUDY DESIGN

Data Quality Objectives (DQOs) are statements that define the type, quality, quantity, purpose and use of data to be collected. The design of a study is closely tied to the data quality objectives, which serve as the basis for important decisions regarding key design features such as the number and location of samples to be collected, the chemical analyses to be performed, etc.

USEPA has published a number of guidance documents on the DQO process (USEPA 1994a, 1994b, 1996), and this project plan has been developed in accord with that guidance. In brief, the DQO process follows a seven-step procedure, as follows:

1. State the problem that the study is designed to address
2. Identify the decisions to be made with the data obtained
3. Identify the types of data inputs needed to make the decision
4. Define the bounds (in space and time) of the study
5. Define the decision rule which will be used to make decisions
6. Define the acceptable limits on decision errors
7. Optimize the design for obtaining data in an iterative fashion using information and DQOs identified in Steps 1-6

Following these seven steps helps ensure that the project plan is carefully thought out and that the data collected will provide sufficient information to answer the key decisions which must be made. The following sections summarize the application of the DQO process to the design of each of the four component parts of the VBI70 Phase III included in this project plan.

## 2.1 <u>Residential Soil Sampling</u>

### 2.1.1 Data Quality Objectives

<u>State the Problem</u>

As noted previously, data from previous investigations at the site suggest that contaminated residential properties exist in an unpredictable pattern, and that the location of a contaminated property cannot be identified based on data from other nearby residences. Thus, the basic problem is to develop a method for identifying all individual properties that have contaminant levels above a level of health concern, and to obtain data from these properties that will allow evaluation of the health risks from direct and indirect contact with the soil.

Decisions to Be Made

Each individual property within the study area will be evaluated to determine whether the concentrations of contaminants are either a) acceptable, or b) potentially unacceptable. These risk-based decisions will, in turn, form an important input to risk management decision-making at the site.

Types of Input Needed

The information needed to make risk-based decisions at a residential property is reliable data on the concentration values in soil at the residence. The key statistic is the arithmetic mean concentration within that property. However, because the true mean concentration within a property cannot be derived with certainty from a limited set of samples from the residence, USEPA specifies that the decision for most chemicals (including arsenic) will be based on the 95% upper confidence limit of the mean (95% UCL) (USEPA 1992a). This, in turn, requires information on the inter-sample variability, and on the shape of the distribution of grab samples from a property (e.g., normal, lognormal).

Bounds of the Study

*Spatial Bounds*

All residential properties within the site boundary that have not been sampled to date will be sampled during Phase III, if authorization for access is granted by the owner. It is estimated that there are approximately 3000 such residential properties. Residential properties that have been sampled previously will not be re-sampled during Phase III unless it is determined that the existing data for a property are not adequate to support a reliable risk assessment and remedial decisions. This determination will be presented in a separate document.

*Temporal Bounds*

All data will be collected during the summer of 1999. However, because concentration values in soil are unlikely to vary significantly over time, the precise time period when collection occurs is not important. Results will be applied to current and future exposure conditions.

Decision Rule

Available data indicate that the basic unit of contamination is an individual property (ISSI 1999b). Therefore, each property will be evaluated on an individual basis. Conceptually, the classification of a property is achieved by performing exposure and risk calculations in accord with standard approaches and method specified by USEPA. For convenience, this approach may be simplified by calculating the maximum concentration value that yields an acceptable risk, and identifying this value as the Risk-Based Concentration (RBC). Then, each property can be classified simply by comparing the appropriate site statistic to the RBC. For arsenic, the risk calculation is based on the 95% UCL for the property, so the classification is achieved by comparing the 95% upper confidence limit of the arithmetic mean (UCL) for the property to the RBC for arsenic. Conceptually, three different RBCs are relevant: acute, subchronic and chronic. However, as demonstrated in Attachment 1, any property that fails the comparison for the acute or sub-chronic RBC will also fail the comparison for the chronic RBC. Thus, only one comparison is needed to identify a property that is of potential concern from arsenic. In the case of lead, the forward going risk calculation is based on the arithmetic mean of lead concentrations within the property, so classification is achieved by comparing the arithmetic mean soil concentration to an appropriate site-specific Risk-Based Concentration (RBC) for lead.

| Chemical | Test Result | Decision |
|---|---|---|
| Arsenic | 95% UCL ≤ RBC<br>95% UCL > RBC | Acceptable<br>Potentially unacceptable |
| Lead | Mean ≤ RBC<br>Mean > RBC | Acceptable<br>Potentially unacceptable |

The RBC for both arsenic and lead will be developed during the feasibility study for the site, after finalization of the human health risk assessment. The RBCs will be designed to protect an individual with Reasonable Maximum Exposure (RME), and will be calculated using all of the same exposure and toxicity values developed for use in the risk assessment. This will include use of all reliable site-specific data available, and may include both deterministic risk assessment approaches and/or probabilistic approaches, as needed to adequately characterize the variability and uncertainty in risk to humans at the site. That is, a range of potential RBCs may be developed, allowing for risk management judgement in selection of an appropriate decision criterion, in accord with the nine criteria described in the National Contingency Plan (40 Code of Federal Regulations [CFR] Part 300).

Acceptable Limits on Decision Errors

In accord with standard risk-based decision-making at Superfund sites, a property will be assumed to be contaminated unless there is at least 95% confidence that the property is actually safe (i.e., alpha = 0.05) (USEPA 1992b).

For arsenic, this is achieved by using the 95% UCL of the mean concentration at the property as the basis for decision making. That is, if the 95% UCL is less than the RBC, there is at least 95% confidence that the true mean value for the property is below the RBC and that risks are within acceptable limits. However, use of the 95% UCL for arsenic means that some properties that are actually safe may be declared to be unacceptable. Generally, the frequency of this type of error should be no more than 20% (USEPA 1992b). For this project, the goal is to ensure that the frequency of this type of decision error is as low as can be achieved with the available sampling and analysis budget.

For lead, 95% confidence that the property is safe is achieved by use of USEPA's Integrated Exposure Uptake Biokinetic (IEUBK) model or other appropriate mathematical model that describes the probability that an individual exposed to a specified set of environmental lead levels will have a blood lead value that is above a level of health concern (10 ug/dL). The RBC is defined as the soil concentration such that the probability of an individual having a value above 10 ug/dL is no more than 5% (USEPA 1994d). It should be noted that the IEUBK model accounts for all sources of lead exposure, not just soil and dust.

### 2.1.2 Study Design

Based on the data quality objectives outlined above, the key design elements of the soil sampling component of the Phase III project are as summarized below.

Sampling Depth

Available data on COPC levels in residential soils are sufficient to establish that when contamination is present in a yard, it is mainly surficial (0-2 inches), and that concentrations of contaminants in subsurface soil tend to be lower than in the surface soil (ISSI 1999c; see Appendix C). Thus, this project will seek to characterize only surficial soil in residential yards. Once properties that are potentially unacceptable are identified, USEPA may choose to collect subsurface soil samples to help determine the appropriate depth of remediation, as appropriate.

Calculation of the 95% UCL

Currently, USEPA has established default methods for calculating the 95% UCL for distributions that are either normal or lognormal (USEPA 1992a):

**Normal:**

$$UCL = m + t_{1-\alpha,n-1} \cdot \frac{s}{\sqrt{n}} \qquad (1)$$

where:
m = arithmetic mean of the data
s = standard deviation of the data
n = number of samples

$t_{1-\alpha,n-1}$ = t-statistic for the (1-$\alpha$) percentile of the t distribution with n-1 degrees of freedom

**Lognormal:**

$$UCL = \exp\left(m_t + 0.5s_t^2 + \frac{s_t H}{\sqrt{n-1}}\right) \qquad (2)$$

where:
$m_t$ = mean of the log-transformed data
$s_t$ = standard deviation of the log-transformed data
n = number of samples
H = H-statistic from table in USEPA (1992a)

Equations for calculating the 95% UCL of the mean for distributions other than the normal and the lognormal are not readily available.

At this site, data from eight residential properties that have been intensively sampled (ISSI 1999b) suggest the distribution of arsenic values within a residential property tends to be right-skewed, at least for properties where concentration values are substantially higher than average (see Figure 2-1). This indicates that a log-normal distribution might be appropriate for characterizing the distributions at such locations. However, tests of the distribution at these impacted properties reveal that the data are not well characterized by a lognormal (or a normal) distribution (Figure 2-2). The distribution of values at properties that are not impacted or minimally impacted (mean concentration = 40-70 mg/kg) appears to be more nearly normal (Figure 2-3), but are still skewed at the low end by the presence of multiple values below the detection limit. Because the distributions are not well characterized as either normal or lognormal, use of either equation 1 or equation 2 as the basis for calculation the 95% UCL based on a series of grab samples might yield results that are not accurate.

One way to minimize problems associated with calculating the 95% UCL of the mean for non-standard distributions is compositing. This is because, regardless of the shape of the parent distribution, the distribution of the values of composite samples will approach a normal distribution if the number of sub-samples is sufficiently large, allowing use of equation 1 for calculation of the UCL of the mean at a property. In addition, the variability between composite samples is less than between grab samples, so uncertainty in the mean of composites samples is usually less than for an equal number of grab samples. For these reasons, the Phase III soil sampling study will utilize compositing of grab samples collected within a property.

Number of Grab Samples per Composite

In order to estimate the number of grab samples per composite needed to reduce intra-composite variability and to ensure that distribution of composites is approximately normal, Monte Carlo simulations were performed using site-specific data from properties that had been intensively sampled (140-160 data points per property) (ISSI 1999b). In these simulations, grab samples of size j (j = 5, 10, 15, 25, 30, 50 grabs per composite) were repeatedly drawn, and the composite mean was calculated as the mean of the grab samples. Then the distribution of the composite values was tested for normality. The results are presented in Appendix D. Based on these tests, a set of 10 sub-samples was found to be adequate to ensure that the distribution of the composites drawn from minimally impacted properties (sample mean = 40-70 mg/kg) will be approximately normal.

At the intensively sampled properties that were clearly impacted (sample mean = 390-2370 mg/kg), the number of grab samples per composite needed to ensure that the distribution of composites is approximately normal is about 15-25. Thus, the distribution of the 10-point composite samples from such a property is likely to be somewhat right-skewed, and use of equation 1 to calculate the 95% UCL could underestimate the true UCL. However, at such a location, it is expected that the identification of the property as potentially unacceptable can readily be made based on a comparison of the sample mean to the RBC. That is, if the sample mean is above the RBC, the property may be classified as potentially unacceptable without regard to the value of the UCL. Therefore, the possibility of incorrectly identifying the property as acceptable when it is really not acceptable is very small.

Number of Composites per Property

The number of composites per yard depends on the acceptable probability of making a Type I (false positive) error. This is the case when a property is incorrectly identified as being above a level of concern when it is actually below a level of concern. In general, as the number of composites increases, the chances of making this type of error decreases. However, the exact number depends on the expected difference between the RBC and the typical level in un-impacted properties. That is, the wider the difference between the mean value at un-impacted properties and the RBC, the fewer samples that are needed to establish that the UCL for an un-impacted property is below the RBC. As noted above, EPA guidance (USEPA 19992b) recommends that the value be no more than 20%, and the goal of the study is to reduce the Type I error rate to the maximum extent that available resources will permit.

In order to investigate the relationship between Type I error rate and the number of composites at this site, a Monte Carlo simulation was performed based on an assumed distribution of arsenic levels in un-impacted properties. This distribution was based on available data on arsenic levels in residential surface soil samples collected in the vicinity of the Globe plant (see Figure 2-4). Each data point represents the measured arsenic value in a four-point composite from a residential property. Values higher than 70 mg/kg were assumed to represent potentially impacted properties, and were not considered in the approximation of the background distribution. Even though these data are from outside the study area for the Phase 3 project, the distribution of values is judged to be reasonably predictive for those that are expected to occur within the study area. Based on these data, the distribution of true property means at an unimpacted property was modeled as:

$$\text{Background} = LN(21,13)$$

where:

LN(21, 13) = lognormal distribution with parameters 21 and 13
21 = mean of the (untransformed) data
13 = standard deviation of the (untransformed) data

From this distribution, a series of random "true means" were selected, each representing a randomly selected background property. The inter-grab sample variability at each property with "true mean" m was simulated based on the observed range of inter-grab-sample variability at the eight properties that had been intensive sampled. At these properties, the coefficient of variation (CV = standard deviation/mean) ranged from about 0.8 to 1.2. Because this range was based on only 8 properties, a slightly wider range of variability (CV = 0.7 to 1.3) was assumed. Based on this, the standard deviation at a simulated property was simulated as:

$$s = m^*CV$$
$$CV = TRI(0.7,1.0,1.3)$$

where:

TRI(0.7,1.0,1.3) = triangular distribution with parameters 0.7, 1.0, 1.3
0.7 = minimum value
1.0 = mode (most likely value)
1.3 = maximum value

For each simulated "true mean" and "true standard deviation", a series of grab samples were selected at random, and combined into n composites of j grab samples per composite. From these, the inter-composite means and standard deviation were calculated and used to calculate the 95% UCL using equation 1 (above). The Type I error rate was assessed by counting the number of properties where the "true mean" was less than the RBC but the 95% UCL was above the RBC.

Because a site-specific RBC has not been derived, it was necessary to assume a value for the purposes of planning the design of Phase III. For arsenic, a value of 70 mg/kg was adopted.

***Note that the use of this value for planning Phase III is not equivalent to a decision that this value is actually appropriate. The actual level of human health risk at 70 mg/kg has not been determined, and the final RBC for soil will be developed only after performance of the site-specific risk assessment, using all available site-specific data, and the final value may be higher or lower than 70 mg/kg.***

Employing an assumed RBC of 70 mg/kg and the estimated background distribution described above, and employing a grab sample size of 10, the simulated Type I error rates are as shown below:

| Number of Composites | Estimated Type I Error rate |
|---|---|
| 2 | 15% |
| 3 | 4.1% |
| 4 | 2.6% |
| 6 | 1.5% |

As seen, if only 2 composites were used, there would be a relatively high probability (about 15%) of declaring a property to be potentially unacceptable when it was actually acceptable. Use of three composites reduces the rate to about 4%, and this error rate can be reduced further by going to 4 or 6 composites. Although a Type I error rate of 4% is very good by most standards, because of the large number of properties which must be evaluated at this site, even a rate this low results in a large number of errors (up to 120 residences).

Based on these findings, a phased approach to sampling and reducing Type I errors was developed. That is, samples collected at each property tested in Phase III will include three composites of 10 grab samples each. All properties whose 95% UCL exceeds the RBC will be considered potentially unacceptable. However, because of the possibility of a Type I error, EPA may consider performing further sampling activities at such locations (especially those where the sample mean is close to or below the RBC) in order to determine whether the property actually does exceed an acceptable level.

<u>Sampling Location</u>

The 30 sub-sampling locations within a yard will be selected in a semi-systematic fashion, as detailed in the Field Sampling Plan (FSP) (Section 3.0).

Sample Preparation

Sub-samples collected at a property will be combined into 3 composite samples in the field, using the standard operating procedures (SOP) provided in Section 3.0. These composite samples will be transported to the laboratory, where each will be air dried and sieved using a 2 mm screen. The purpose of this sieving is to remove all large objects and debris such as twigs, clumps of grass, etc. Currently, EPA Region 8 recommends that soil samples used for human health risk assessment purposes be sieved a second time in order to isolate the very fine fraction (less than 250 μm) from the larger soil particles. This is because it is assumed that human exposure is more likely to be to the fine particles than the coarse particles. However, in this case, a previous study at the site (ISSI 1998b) has demonstrated that there is very little difference in contaminant concentration between the fine fraction (< 250 μm) and the bulk fraction (< 2 mm). Therefore, sieving to isolate the fines is not needed for all samples. However, sieving and analysis of the fine fraction will be performed on a selected subset of the soil samples in order to confirm the expectation that concentration values are not higher in fine particles than in bulk soil.

Analyte List

As noted above, data currently available establish that the chemicals of potential concern (COPCs) at this site are arsenic and lead (ISSI 1999a; see Appendix A). Other chemicals either are not of health concern, or contribute a risk much lower than that contributed by arsenic. Thus, the analyte list for all samples collected during this project is:

Arsenic
Lead

Analytical Method and Detection Limits

Lead and arsenic will be measured in soil samples by fixed-base x-ray fluorescence (XRF). Although health-based criteria have not yet been formally established at this site for either lead or arsenic, experience at other sites has shown that arsenic must be measured with a detection limit no higher than about 30 mg/kg, and lead should be measured with a detection limit no higher than about 50 mg/kg. Based on this, acceptable detection limits at this site will be no higher than:

| | |
|---|---|
| Arsenic: | 20 mg/kg |
| Lead: | 20 mg/kg |

Data Interpretation/Data Use

Surface soil data generated during this part of the Phase III project will form the basis for evaluating the potential human health risks at each property. This will be done following standard methods established by the USEPA for assessing health risks to residents from arsenic and lead. That is, a property will be declared acceptable if the 95% UCL for arsenic is less than the RBC for arsenic AND the arithmetic mean for lead is less than the RBC for lead. If either the 95% UCL for arsenic or the mean concentration for lead exceed the corresponding RBC, the property will be considered to have potentially unacceptable human health risk. If a property is identified as potentially unacceptable, USEPA may either remediate the property in its entirety, or may perform further sampling to determine with greater confidence a) whether remediation is actually needed, and if so, b) which part or parts of the yard require remediation.

## 2.2 Indoor Dust Sampling

### 2.2.1 Data Quality Objectives

State the Problem

Contaminants in outdoor soil are able to enter homes through airborne and direct transport pathways, and can contribute to contamination of indoor dust on floors, tables, counter tops, etc. Currently, USEPA assumes that about 55% of the total exposure to contaminants in soil occurs indirectly via ingestion of indoor dust (USEPA 1994c). Thus, reliable estimates of the indoor dust concentration is an important part of the risk assessment process.

Collection of indoor dust samples, however, is difficult and costly. Therefore, the problem is to establish a scientifically sound approach for estimating the expected indoor dust concentrations at a residence based on measurements of contaminant levels in yard soil for that residence.

Decisions to Be Made

The decision to be made is the value to be assumed for the concentration of each chemical of potential concern in indoor dust, given only the concentration of that chemical in yard soil.

Types of Input Needed

The basic approach for estimating dust concentrations at locations where they have not been measured is to obtain a robust set of "paired" data on contaminant levels in yard soil and indoor dust (i.e., both measurements are from the same property). These data are fit to an appropriate equation using computer-based regression techniques, and the resultant equation is used to impute dust concentrations from measured soil concentrations. At other sites, a simple linear model has generally proved to be adequate:

$$C_{dust} = D_0 + k \cdot C_{soil}$$

Thus, the inputs needed to establish the parameters of this relationship are an adequate set of paired measurements of COPC levels in indoor dust and outdoor yard soil at multiple residences within the site boundaries.

Bounds of the Study

Any residence for which a reliable soil sample is available is a candidate for collection of a paired indoor dust sample. As discussed below, locations for collection of indoor dust will be stratified to achieve spatial representativeness (across neighborhoods), and will also be stratified to ensure a wide range in soil sample concentrations.

Decision Rule

The concentration of a COPC in indoor dust at a residence will be estimated from the measured value in soil using the best fit equation through the paired soil-dust data.

Acceptable Limits on Decision Errors

If the value of the concentration of a COPC is not known with certainty in either the soil sample or the dust sample, linear regression analysis of the paired samples will tend to underestimate the true slope of the correlation. Thus, the goal is to ensure that the measured values of the concentration in soil and the concentration in dust are sufficiently accurate that the slope of the regression line is within 30% of the true slope.

### 2.2.2 Study Design

Based on the data quality objectives outlined above, the key design elements of the indoor dust sampling component of the Phase III project are as summarized below.

Sample Number

Data obtained from previous sampling programs at VBI70 were used to estimate the total number of samples required for the study. Based on a soil sample that is a composite of 10 sub-samples, Monte Carlo simulation indicated that reliable results could be obtained if the number of paired soil-dust samples is approximately 50-100. Thus, this part of the Phase III project will collect an indoor dust sample from no fewer than 60 and no more than 90 residences where composite soil samples have been collected.

Sample Locations

Indoor dust sampling locations will be selected to ensure a representative spatial coverage of the site, as well as a suitable range of lead and arsenic concentrations in soil. That is, approximately 10-15 sampling locations will be selected from each of the six neighborhoods which comprise the study area, and locations will be selected to include approximately equal numbers of samples from properties with soil arsenic concentrations in each of the following ranges: low (less than 100 mg/kg), medium (100-300 mg/kg), and high (greater than 300 mg/kg). Special effort will be made to include properties with the highest contamination levels (e.g., greater than 500 mg/kg), since these locations are especially helpful in defining the relationship between soil and dust.

Sample Collection

One composite dust sample consisting of 8-14 sub-samples will be collected at each residence. This composite will be collected using a high-volume vacuum collection device. The sub-samples will be collected in rooms or other living areas ("living spaces") where the residents are most likely exposed including: bedrooms, family and/or television rooms, kitchens, hallways and entryways. In order to standardize the collection process, dust samples will be collected using a template to define the area to be vacuumed. In most cases, 2 templates will be collected per living space. Thus, the total number of templates collected within a residence will be dependent upon the number of living spaces available. For example, if there are 2 bedrooms, a family room, a kitchen and a hallway, and if two sub-samples are collected in each living space, there would be a total of 10 sub-samples in the composite for that residence. In the case where a residence has more than 10 living spaces, only 1 template per living space will be collected. This approach is recommended so that 20-30 sub-samples are not collected for a large residence. Details on the locations within each living space where dust will be collected are provided in the FSP (Section 3.0).

The total mass of dust collected in the composite sample must be at least one gram. If a 1-gram sample is not collected using the protocol above, additional templates should be collected from appropriate living areas until sufficient mass is collected.

Sample Preparation

Each dust sample will be sieved as detailed in SOP ISSI-VBI70-03 in order to remove non-dust components.

Sample Analysis

The analyte list for indoor dust is the same as selected for soil (arsenic, lead).

Because the mass of dust collected from a residence is often too low to support reliable quantification by XRF techniques, samples will be sieved to removed lint and/or hair, prepared using a nitric acid digestion, and analyzed using standard USEPA protocols via either graphite furnace atomic absorption (GFAA) or Inductively Coupled Plasma/Mass Spectrometry (ICP/MS). Detection limits for this method are approximately:

As = 5.0 mg/kg
Pb = 1.0 mg/kg

Data Interpretation/Data Use

Data collected from this study will be used to quantify the average (site-wide) relationship between outdoor yard soil contamination and indoor dust contamination. This will be done by preparing a graph of the paired soil-dust concentrations for each analyte, and finding the best-fit regression equation through the data. At other sites, a simple linear model has proved to be appropriate:

$$C_{dust} = D_0 + k^*C_{soil}$$

The value of $D_0$ indicates the average "background" level of analyte expected in indoor dust, and k is the average increment in indoor dust concentration per unit concentration in outdoor soil. This equation can be used to help increase the accuracy of the human health risk assessment at the site, as well as increase the accuracy of the site-specific RBC for soil.

In the event that one or more dust samples are located in which interior contaminant levels are substantially higher (more than 5-fold) that the mean concentration in outdoor yard soil, and are in a range of potential health concern, USEPA may re-visit that property and collect additional samples in order to a) confirm that the original data are accurate, and if so, b) identify likely non-yard sources of dust contamination. If non-yard sources of interior dust contamination are identified at one or more residences, and if the levels are in a range of potential health concern, these locations will be referred to appropriate agencies for investigation and follow-up.

## 2.3 Alley Soil Pilot Study

### 2.3.1 Data Quality Objectives

State the Problem

Unpaved alleyways exist at a number of locations in the study area, and vehicular traffic on the alleyways often raises substantial amounts of dust. If these alleyways are contaminated with arsenic and/or lead, this airborne transport of dust could be a source of concern for nearby residents, for several reasons:

1) Direct inhalation of the dust
2) Contamination of otherwise uncontaminated yard soils
3) Contamination of indoor dust

Of these three pathways, contamination of indoor dust is likely to be the greatest reason for concern.

Decisions to Be Made

The decision to be made with the data collected during this pilot study is:

*Is there evidence that alleyways contain levels of contaminants that are of potential human health concern?*

If so, further studies will be planned to define the nature and extent of alleyway contamination. If not, exposure from alleyways will not be addressed further.

Types of Input Needed

The input needed to make this decision is data on the concentrations of chemicals of concern in alleyway soils at multiple locations within the site.

Bounds of the Study

Any unpaved alley within the boundary of the site is a candidate location for collecting alley soil samples during the pilot project.

Decision Rule

There is no standard risk-based decision rule established by USEPA for evaluation of contamination levels in alleyways, since the magnitude of human exposure from soil in such locations is not known. Based on the assumption that exposure in an alleyway is likely to be substantially less than at a person's house, any alley where the 95% UCL for arsenic and the mean concentration for lead are less than or equal to the corresponding RBCs for a residential yard will be considered to be clearly acceptable.

If any alleyway is located where the 95% UCL for arsenic or the mean for lead exceeds the RBC for residential yards, USEPA will perform a more detailed study to characterize the nature and extent of the contamination, and to estimate the risk to area residents.

Acceptable Limits on Decision Errors

Because the ally sampling plan is a pilot study and is not intended to make final risk-based decisions, no formal quantitative limits on decision errors are required. However, because the screening-level assessment will be based on a comparison of the 95% UCL to the residential soil RBC, it is important that the 95% UCL not be unnecessarily elevated, since this could lead to a high frequency of declaring an alleyway to be potentially unsafe when it really is safe. Therefore, the goal of this phase of the study is that the 95% UCL be within 40% of the sample mean.

### 2.3.2 Study Design

Based on the data quality objectives outlined above, the key design elements of the alley soil pilot study component of the Phase III project are as summarized below.

Sample Number

Calculation of the number of samples needed to ensure that the 95% UCL is within 40% of the sample mean requires knowledge of the expected variability between samples from alleyways. Since no such samples exist at present, the value of n cannot be calculated with confidence. However, based on experience at other sites, it is expected that a data set of 20-30 samples from an alley will be sufficient to achieve this goal.

Sample Locations

Alleys to be sampled will be selected based on the results of the residential soil sampling project. Preference will be given to alleys that are adjoined by multiple properties that have been sampled, and where at least one of the properties is clearly impacted by arsenic (e.g., mean value is greater than 200 mg/kg). A total of 4-6 such alleys will be sought, each consisting of one city block.

The location of samples within each alley will be defined by a systematic grid laid out over the surface of the alley, as detailed in the FSP (Section 3.0).

Sample Collection

Soil samples from each sampling location will be collected using a procedure similar to that for yard soil, except that compositing of samples will not be performed. This is so that if there are isolated areas of contamination in the alley, the presence of these locations can be observed.

Sample Preparation

Soil samples from alleyways will be dried and sieved through a 2 mm screen.

Sample Analysis

All alley soil samples will be analyzed using the same method as used for yard soil samples.

Data Interpretation/Data Use

The data from this pilot study will be used to judge if there is a basis to be concerned over chemical contamination of soils in alleyways. This will be done by comparing the 95% UCL of the mean for arsenic and the mean for lead to RBCs based on residential exposures. If the values are below the RBCs, it will be concluded that alley soils are not of concern. If one or both chemicals exceeds its RBC, further studies will be performed to characterize the nature and extent of alleyway contamination and the magnitude of the human health risk, as needed.

## 2.4 Characterization of Schools and Parks

### 2.4.1 Data Quality Objectives

State the Problem

Area residents (especially children) may be exposed to contaminants not only at their residence, but also at neighborhood schools and parks. Available data collected to date suggest that neither schools nor parks are a source of concern (UOS 1998a, 1998b), but some locations have not yet been sampled.

Decisions to Be Made

Each school yard and park within the study area will be evaluated to determine whether the concentrations of contaminants are either a) acceptable, or b) potentially unacceptable. These risk-based decisions will, in turn, form an important input to risk management decision-making at the site.

Types of Input Needed

Data required to evaluate each school yard and park are reliable and accurate measurements of the concentration of each chemical of potential concern in representative surface soil samples from each location.

Bounds of the Study

Table 2-1 lists all schools and parks within the study area. Those that have been studied previously will not be re-investigated during Phase III. Locations that have not been studied to date and which will be sampled during Phase III are indicated in the Table.

Decision Rule

Each schoolyard and park will be evaluated using a decision rule analogous to that for residential properties:

| Chemical | Test Result | Decision |
|---|---|---|
| Arsenic | 95% UCL ≤ RBC<br>95% UCL > RBC | Acceptable<br>Potentially unacceptable |
| Lead | Mean ≤ RBC<br>Mean > RBC | Acceptable<br>Potentially unacceptable |

Note that, because of differences in duration and frequency of exposure, the RBC for arsenic and/or lead may not be identical at schools, parks and residences. Each type of RBC will be developed during the feasibility study for the site, after finalization of the human health risk assessment. The final RBCs will be calculated using all of the same exposure and toxicity values developed for use in the risk assessment. This will include use of all reliable site-specific data available, and may include both deterministic risk assessment approaches and/or probabilistic approaches, as needed to adequately characterize the variability and uncertainty in risk to humans at the site. That is, a range of potential RBCs may be developed, allowing for risk management judgement in selection of an appropriate decision criterion.

Acceptable Limits on Decision Errors

The maximum acceptable probability that a school yard or park will be declared acceptable when it really is not acceptable is 5%. As above, the probability of declaring the property potentially unacceptable when it really is acceptable will be reduced to the lowest level possible with the available sampling and analysis budget.

### 2.4.2 Study Design

Based on the data quality objectives outlined above, the key design elements of the school/park sampling component of the Phase III project are as summarized below.

Sampling Depth

All samples will be collected from the 0-2 inch depth interval.

Number and Location of sample Collection

The number and location of sample collection at each school and park included in Phase III will be detailed in an addendum to the FSP (Section 3.0), after survey of each target property.

Sample Preparation and Analysis

All samples will be prepared and analyzed in the same way employed for residential soil samples.

Data Interpretation/Data Use

A schoolyard or park will be declared acceptable if the 95% UCL for arsenic is less than the use-specific RBC for arsenic AND the arithmetic mean for lead is less than the use-specific RBC for lead. If either the 95% UCL for arsenic or the mean concentration for lead exceed the corresponding RBC, the property will be considered to have potentially unacceptable human health risk. If a property is identified as potentially unacceptable, USEPA may either remediate the property in its entirety, or may perform further sampling to determine with greater confidence a) whether remediation is actually needed, and if so, b) which part or parts of the yard require remediation.

**Table 2-1 List of Schools and Parks**

| Category | Name | Sampling Status | |
|---|---|---|---|
| | | Completed | Phase III |
| School | Garden Place | | X |
| | Mitchell | X | |
| | Annunciation | | X |
| | Harrington | X | |
| | Swansea | X | |
| | Cole Middle School | X | |
| | Wyatt-Edison | | X |
| | Pioneer | | X |
| | Northeast Montessori | | X |
| | Family Star Montessori | | X |
| | Johnson Headstart | | X |
| | Montessori-Garfield Headstart | | X |
| | Potential new school ($44^{th}$ & Steel) | | X |
| | Clayton Foundation | | X |
| Park | Swansea | X | |
| | Elyria | X | |
| | Schafer | X | |
| | Russel Square | X | |
| | Nairobi | X | |
| | Saint Charles Place | X | |
| | Durham | X | |

# 3.0 FIELD SAMPLING PLAN

This Field Sampling Plan describes the methods and procedures required for implementation of field sampling activities planned as part of the VBI70 Phase III Field Investigation including: descriptions of the sampling locations; number of samples planned for collection; sample matrices; and methods for sample collection, handling and analysis. Additionally, procedures associated with obtaining property access, waste management and disposal and health and safety are also outlined in this section of the Project Plan.

In general, the steps required for successful implementation of this FSP include:

- Obtain a list of eligible properties for Phase III sampling
- Obtain property access authorization
- Collect samples (e.g., residential yard soil, indoor dust)
- Submit samples under chain-of-custody for analysis
- Perform sample preparation steps
- Perform sample analysis

At each step where data are collected, data must be incorporated into the project database in an accurate and timely fashion in accord with procedures outlined in the Data Management Plan (DMP) in Section 5.0. A sample flow diagram outlining the overall steps for field data collection activities is presented in Figure 3-1.

## 3.1 Staff Identification

All USEPA personnel and contractors participating in the field sampling or oversight efforts must wear identification at all times. This important to show residents or observers that field personnel are a part of the Phase III field investigation and belong onsite. Identification (ID) badges should have the name and recent photograph of the person. ID badges must be worn on site and clearly visible at all times.

## 3.2 Property Access Agreements

As noted previously, approximately 3000 residences are eligible for yard sampling and analysis as part of Phase III. An eligible residential property is any property located within the study boundaries (See Figure 1-2) that has not already had yard soils measured for arsenic and lead as part of Phases I and II (UOS 1998a, 1998b). Written authorization to sample the yard soil must be granted by the property owner prior to sampling. The general process for obtaining and maintaining documentation on property access authorization is summarized in the following subsections. Specific details for obtaining access agreements are provided in the standard operating procedures (SOPs) (Appendix E).

In the event that a residence is selected for supplemental sampling, separate access agreements will be obtained prior to collection of any additional samples. If access inside the residence is necessary (e.g., for collection of indoor dust samples) and the property owner is not the resident, written authorization from the renter/leaser allowing access inside the home must also be obtained and recorded.

### 3.2.1 Obtaining Access Agreements

Two methods, implemented in a staged fashion, will be employed in an effort to obtain access authorization from as many eligible residential properties as possible. These methods are: a) site-wide mailing; and b) door-to-door interviews.

#### 3.2.1.1 Site-Wide Mailing

List of Addresses

An attempt will be made to contact all property owners and/or residents within the study by U.S. mail to inform each of the plans for the VBI70 Phase III sampling. A current (1998) database containing all tax assessor data for the study area will be purchased. This information will be used to obtain the most current property owner and address data available. After receipt of the database, a copy of the raw database will be stored with data management personnel. The raw database will then be refined as follows:

- Remove any properties that are outside of the study boundaries
- Remove all addresses within the study boundaries for which adequate sampling data are currently available

The revised database (termed the Access Agreement DB) will be forwarded to MK to begin compiling a list of residences to include on the mailing list. After the mailing list is compiled, USEPA will prepare the components of each letter. Because there is a large population of Spanish-speaking residents within the VBI70 site, all documentation prepared for distribution to the public must be available in both Spanish and English versions.

Information to be Distributed

The following information will be distributed to each resident/property owner:

- Cover letter
- Phase III Sampling Fact Sheet
- Access agreement form
- Self-addressed stamped envelope

Examples of the cover letter, the fact sheet, and the access agreement are provided in the SOP (Appendix E). In addition, a letter from community representatives will also be included in the materials distributed to area residents.

Updates/Corrections to Access Agreement Database

In some cases, the database obtained from 1998 tax assessor data may not reflect recent changes in property ownership, and maybe inaccurate or incomplete regarding the type of building (residential, commercial) at specified addresses. Therefore, as field work is undertaken and more accurate information is obtained, updates to the Access Agreement DB will be incorporated.

#### 3.2.1.2 Door-to-Door Recruitment

In cases where no response is received following the site-wide mailing (see above), a team of two people will visit each residence in order to attempt to obtain authorization for soil sampling access. Due to the large number of Spanish-speaking citizens residing in the study area, at least one member of the interviewing team must be bilingual (Spanish and English). Each team will have available and will provide to each resident contacted the same set of information and authorization forms that were distributed by mail. The team will describe the goal of the project and clearly state the need for property access. Additionally, the team will explain that authorization onto the property must be given by the property owner. If access is granted, the agreement form will be signed and given to the interviewing team. Authorized members of MK's data entry team will update the Access Agreement DB to indicate whether access was approved or denied as responses are received by the interviewing teams.

#### 3.2.1.3 Follow-up Mailings and Recruitment Activities

Follow-up mailing or door-to-door visits may be implemented at either the soil or indoor dust sampling activities. The RPM will decide whether additional recruitment activities are necessary after receiving the results of the participation rates for each recruitment stage.

### 3.2.2 Documentation

Recruitment

A cumulative list of all residences that have received mailings and that have been visited will be maintained. This list will document the date when a letter was sent, and the date(s) and time(s) when house visits were performed, along with a record of the outcome (no response, authorization, refusal).

Access Agreements

All signed access agreements will be maintained in a bound logbooks (e.g., three-ring binders). The original signed forms must be placed in a binder and paginated (sequentially numbered) as each new agreement form is received. Data fields that track when access agreement letters are distributed and when access agreement forms are received will be included and updated in the Access Agreement DB in accord with procedures outlined in the DMP (Section 5.0).

## 3.3 Phase III Field Sampling

After authorization for property access is granted by a sufficient number of property owners to make field implementation effective, the field crew will be assembled. The field crew will be comprised of a Field Project Leader (FPL) who will supervise all field activities, a Field Quality Assurance Coordinator (FQAC) who will ensure that field activities are implemented in accord with project requirements and field samplers (8 teams of two) who are experienced in sampling methods stipulated for this project. Field sampling activities contained within this project plan for the Phase III investigation have been divided into three major components: residential surface soil, indoor dust sampling and alley sampling. Each of these components are described in the following subsections. Each subsection contains the following information (as applicable). References in parentheses refer to components required by the USEPA guidelines for development of a Quality Assurance Project Plan (QAPP) (USEPA 1998).

- Identification of Sample Locations (B1)
- Measurement of Field Parameters (B1)
- Sampling Method Requirements (B2)
- Sampling Protocols (B2)
- Field Documentation (B3)
- Analytical Method Requirements (B4)
- Sample Preparation (B4)
- Analytical Methods (B4)
- Detection Limit Requirements (B4)

Other key information pertaining to quality assurance/quality control procedures necessary for successful implementation of the investigations are outlined in the QAPP (Section 4.0).

## 3.4 Residential Yard Soils

Residential yard soils will be collected at each residential property for which access has been granted by the property owner. Because residential yard samples will be collected outside of the home, no appointments to schedule sampling events are required.

### 3.4.1 Residence Identification

The field team will be provided with the street address for each residence to be sampled. The field team will carefully confirm that they have located the specified residence by confirming that the street number and name match. Whenever possible, verbal confirmation of the address will be obtained by speaking to the resident.

### 3.4.2 Identification and Collection of Yard Soil Samples

All yard soil samples will be collected in accord with the Residential Soil Sampling for Yard and Alleyway Soils SOP #ISSI-VBI70-02 Revision 0 (Appendix E). In brief, surface soils (0-2 inches) will be collected at each of 30 sub-locations at each residence, and these 30 sub-samples (grab samples) will be combined in the field into three composite samples. The details for identification and placement of the grab sample locations at each residence is provided in the SOP (Appendix E) and are summarized below. The FPL or designate will be trained in this procedure in order to ensure replicable sampling assignment. There are four major steps in grab sample location identification. They are:

- Draw a field diagram of the property and its major components approximately to scale
- Estimate the samplable area in the yard
- Divide the samplable yard into 5 subsections
- Place 6 flags in each subsection

Field Diagram

The FPL or designate will visit a residence at the time of sampling to assign the sampling scheme. The FPL will pace off the major attributes of the residence (e.g., dimensions of the property boundary, house, garage, driveway, etc.) and prepare a field diagram to approximate scale (± 5 feet on each measurement). The goal is not have a drawing to scale, but instead to have an estimate of the total samplable area in the residential yard. Figure 3-2 provides an example of a typical residence at the VBI70 site that has been drawn on a grid.

Estimate the Area in the Yard

The total area of the yard that is available for sampling will be estimated by counting the number of squares (grids) that comprise the yard. The total number of squares will be estimated to the ½ square. In the example (Figure 3-2), the samplable area is approximately 45 squares.

Divide the Yard Area into Subsections

The samplable property will be divided into 5 subsections of approximately equal area using natural boundaries such as the house, garage, sidewalk or gardens as division markers (See Figure 3-3). In the example, each subsection is made up of about 9 squares (± 1 square).

Flag Placement in Each Subsection

As discussed previously, a total of 30 samples will be identified using marker flags of any three different colors (e.g., 10 red, 10 blue and 10 yellow). Six (6) marker flags (2 red, 2 blue and 2 yellow) will be used to identify each sample location within a subsection. As seen in Figure 3-3, the locations of each marker flag should be approximately equidistant from the other flags within each subsection. Additionally, each color flag should be alternately placed so that same color marker flags are not clustered.

Yard Soil Sampling

The first 10-point composite will be collected by combining the samples at flags of similar color (e.g., red). Grab samples will be collected from the 0-2 inch soil horizon approximately 3-6 inches from each marker flag. Each sample will be collected using a clean coring tool (3-inch diameter) (Appendix E). Each grab sample marked by a red flag will be placed into a single ziplock bag and labeled in accord with the Sample Identification and Tracking SOP# ISSI-VBI70-01 Revision 0 (Appendix E). Because property sizes and obstacles present at each residence may vary significantly, actual sample locations will be identified using a diagram that will be drawn for each individual property sampled. If obstructions are present at the intended sampling locations (e.g., sidewalk, shed, garden, etc.), the sample point should be offset so that a surficial yard soil may be collected, then the actual sample location must be correctly documented on the field diagram. The second and third 10-point composite samples will be collected in identical fashion but by sampling next to the blue and yellow flags, respectively.

If disposable sampling equipment is not used during the sampling event, decontamination procedures must be performed before that equipment may be reused. Decontamination must be performed between collection of composite samples in accord with procedures outlined in Section 3.9 and the soil sample collection SOP (Appendix E).

Each field team will carry a three-ring binder that holds the VBI70 Soil Sample Data Sheets (Figure 3-4). These binders will only contain the paperwork necessary to complete a single day of sampling. One data sheet will be completed for each residence, since the data recorded at each property are applicable to each of the three composites collected at that property. Any deviations from standard protocols or notable events (e.g., rainy weather, etc.) should be entered in the section for "Notes". The field team leader will sign the form when sampling is complete and all data are entered onto the form. The field team will not proceed to the next residence until samples are stored in a cooler and paperwork is complete.

At the end of each day of sampling the field teams will return to the Site Office to check-in samples, paperwork and unused sample labels. Samples will be locked and stored under chain-of-custody until they are forwarded for sample preparation and analysis.

### 3.4.3 Field Documentation

Each sampling team will maintain two forms of field documentation. As discussed above, each team will have a binder containing all field data sheets. Additionally, each team will carry a bound field logbook (not a three-ring binder). Information contained in this log includes the following:

- Sample date
- Sample team ID
- Names of sample team members
- Weather conditions
- Time sampling begun each day
- Time sampling concluded each day
- Any information that is not limited to a single residence (e.g., deviations to sampling protocols)
- Signature of data logger.

This logbook will be maintained daily during sampling activities.

### 3.4.4 Sample Preparation

After composite soil samples have been collected, they will be submitted under chain-of-custody for sample preparation. Sample preparation will be performed in accord with the Sample Preparation for XRF Analysis SOP Revision 0 (Appendix E).

Preparation of Bulk Samples

In brief, all composite samples from the field (referred to as "raw" field samples) will be air-dried and sieved to remove material larger than 2 mm using a #10 stainless steel sieve. The entire mass of each entire raw sample will be sieved in this way. Any material not passing through the 2 mm sieve will be disposed of as IDW. After sieving, the sample passing the sieve (now referred to as the "bulk" sample) is placed into a new ziplock bag that is labeled with the original sample ID number, except that the suffix is "B" (for bulk) rather than "R" (for raw). From this bag, a 10-g sample is removed and placed in a new ziplock bag, labeled with the sample ID (suffix = R) and forwarded to the XRF analyst for testing. A record of all air-drying and sieving procedures must be documented in the Field Sample Preparation Logbook (Figure 3-5). Information such as the sample ID, date of sample preparation, sieve size and the duration of air drying will be included in the log.

Preparation of Fine Samples

Selected bulk samples will be identified for a second sieving step in order to isolate a fraction of fine particles for analysis. This step will be performed to confirm expectation that arsenic and lead levels are not significantly different in the bulk and fine fractions. This step will be performed for about 60-90 residences. These residences will be selected so that soil concentrations span the range of reported metals concentrations.

The fine sample is prepared by removing a portion of the bulk sample (about 100 g) and sieving through a #60 stainless steel sieve. After sieving, the material that does not pass through the screen is disposed of as IDW, and the material that does pass through the screen is placed into a new ziplock bag labeled with the original sample ID number and the suffix "F" (for fine). A 10-g portion of the fine material is removed and placed in a new ziplock bag, labeled with the sample ID (suffix = F) and forwarded to the XRF analyst for testing.

Decontamination

If disposable sieves or other equipment are not used during sample preparation, decontamination procedures must be performed before the tools or equipment may be reused. Decontamination must be performed between samples sieved in accord with procedures outlined in Section 3.9 and the sample preparation SOP (Appendix E).

QA/QC Samples

At the appropriate frequency (See Section 4.0) or as directed by the FQAC, QC samples such as splits or blind standards are inserted into the sample stream. These samples will be logged into the Field QC Sample Logbook (Figure 3-6 and 3-7) and assigned a sample ID. This document is a bound (not a three-ring binder) logbook maintained by the sample preparation technician. The appropriate sample ID numbers and labels will be checked-out from the FPL.

Sample preparation must be performed by a technician who will not perform XRF analysis because samples submitted for XRF analysis must be blind. That is, the sample stream will include both investigative samples as well as blind QC samples. Every effort must be made to maintain sample anonymity.

### 3.4.5 Analytical Method Requirements

Arsenic and lead testing will be performed on all residential soil samples using XRF, providing the chosen XRF methodology can achieve the project-required detection limits (See Section 4.0). A method detection limit study for the chosen instrumentation and proficiency tests for all analysts who will work on the VBI70 Phase III project must be provided to USEPA before analysis of any field samples may proceed. XRF analysis will be performed in accordance with the SOP (Appendix E).

## 3.5 Indoor Dust Samples

As discussed in Section 2.0, indoor dust samples will be collected during the Phase III to obtain more information about the site-specific soil:dust ratio at the VBI70 site. This section outlines the details for field collection of indoor dust samples.

### 3.5.1 Identification of Indoor Dust Samples

A minimum of 60 and a maximum of 90 residences will be identified for indoor dust collection. Locations for collection of indoor dust will be stratified to achieve spatial representativeness and to ensure a wide dynamic range in metals concentrations in yard soil. Stratification will be assigned based on results of residential yard soil measurements and the location of each residence. About 10-15 sampling locations will be selected from each of the six neighborhoods that make up the VBI70 site. Locations will be selected to include approximately equal numbers of samples from properties with soil arsenic concentrations in each of the following ranges: low (<100 mg/kg), medium (100-300 mg/kg) and high (>300 mg/kg). Special priority will be given to properties with the highest contamination levels (e.g., >500 mg/kg), since these locations are especially helpful in defining the relationship between soil and dust.

### 3.5.2 Scheduling Dust Sampling

After residences are identified for indoor dust sampling based on yard soil levels and proximal location, each resident must be recruited. At the time of recruitment, the sampling teams will attempt to obtain authorization to collect dust samples immediately. These impromptu visits will reduce the chance that a resident will vacuum the carpet prior to sample collection. Since this method of recruitment may not be entirely successful, appointments to visit prospective homes may be necessary. The Indoor Dust Collection SOP ISSI-VBI70-03 Revision 0 (Appendix E) stipulates that residents may not vacuum their home for at least seven days prior to sampling, therefore appointments must be made at minimum seven days in advance and clear instructions to avoid vacuuming the home must be given. All scheduled appointments must be entered into the Indoor Dust Scheduling Logbook, which is a bound (not a three-ring binder) log of daily appointments (Figure 3-8).

Missed Appointments

Once an appointment for indoor dust sampling is made, the field team will visit the residence at te appointed time to collect the sample. In the event that no one answers the door, the field team will call the resident using a mobile phone. The team will remain at the residence for at least 15 minutes in case the resident is running late. After 15 minutes has passed without response from the resident, the field team will leave a note on the door reminding about the missed appointment and a phone number to call to reschedule the appointment. Residents will be rescheduled only once. If the resident misses 2 scheduled appointments, this will be interpreted as participant withdrawal and another residence will be selected.

### 3.5.3 Collection of Indoor Dust Samples

All indoor dust samples will be collected in accord with the Sampling for Indoor Residential Dust SOP #ISSI-VBI70-03 Revision 0 (Appendix E). In brief, one composite dust samples will be collected at each residence using a high-volume vacuum collection device. The composite sample will consist of 8-14 sub-samples (each covering about 4 square feet) taken from living areas (termed living spaces) of the home where the residents are most likely exposed including: bedrooms, family and/or television rooms, kitchens, hallways and entryways. A minimum 1-g dust sample is required before sampling may be considered complete. If a 1-g sample is not collected using the protocols outlined in the SOP, additional templates should be collected from appropriate living areas until sufficient mass is collected. The composite samples will be collected into a bottles that will be covered with a cap and labeled in accord with the Sample Identification and Tracking SOP# ISSI-VBI70-01 Revision 0 (Appendix E).

All reusable indoor dust sampling equipment (e.g., nozzle, etc.) must be decontaminated between residences in accord with procedures outlined in Section 3.9 and the dust collection SOP (Appendix E).

Each field team will carry a three-ring binder that holds the VBI70 Indoor Dust Sample Data Sheets (Figure 3-9). These binders will only contain the paperwork necessary to complete a single day of sampling. One data sheet will be completed for each residence. Any deviations from standard protocols or notable events should be entered in the section for "Notes". The field team leader will sign the form when sampling is complete and all data are entered onto the form. The field team will not proceed to the next residence until samples are stored in a cooler and paperwork is complete.

At the end of each day of sampling the field teams will return to the Site Office to check-in samples, paperwork and unused sample labels. Samples will be locked and stored under chain-of-custody until they are forwarded to the commercial laboratory for sample preparation and analysis.

### 3.5.2 Field Documentation

Each sampling team will maintain two forms of field documentation. As discussed above, each team will have a binder containing all field data sheets. Additionally, each team will carry a bound field logbook (not a three-ring binder). Information contained in this log includes the following:

- Sample date
- Sample team ID
- Names of sample team members
- Time sampling begun each day
- Time sampling concluded each day
- Any information that is not limited to a single residence (e.g., deviations to sampling protocols)
- Signature of data logger

This logbook will be maintained daily during sampling activities.

### 3.5.3 Sample Preparation

After samples have been collected, they are submitted under chain-of-custody to a commercial laboratory sample preparation and analysis. Samples will be sieved to remove foreign objects such as lint or hair using a 150 μm screen. An acid digestion is then performed on the fines fraction of the dust sample. Sample digestions will be performed in accord with USEPA SW-846 Method 3050/3051 (Appendix E).

### 3.5.4 Analytical Method Requirements

Arsenic and lead testing will be performed on all indoor dust samples using either GFAA or ICP-MS, providing the chosen methodology can achieve the project-required detection limits (See Section 4.0). A method detection limit study for the chosen instrumentation and proficiency tests for all analysts who will work on the VBI70 Phase III project must be provided to USEPA before analysis of any field samples may proceed. GFAA or ICP-MS analysis will be performed in accordance with USEPA SW-846 Methods 7060/7421 or 6020, respectively (Appendix E).

## 3.6 <u>Alley Samples</u>

A subset of unpaved alleyways that exist within the study area will be characterized for arsenic and lead levels in surficial soils as part of the Phase II field investigation. Details of the field activities are summarized in the sections below.

### 3.6.1 Identification and Collection of Alleyway Soil Samples

Because the Phase III investigation of alley soils is a pilot study, not all alleyways within the Phase III study area will be sampled. Rather, about 4-6 alleyways will be chosen for characterization. Alleys to be sampled will be selected based on results of the residential soil sampling phase of the field investigation. Preference will be given to alleys that are adjoined by multiple properties that have been sampled, and where at least one of the properties is clearly impacted by arsenic (e.g., mean value is greater than 200 mg/kg). A total of 4-6 alleys will be identified, each consisting of one city block.

Prior to sampling the FQAC or designate will provide maps that identify the chosen alleyways and individual sample locations. The map will be generated using GIS tools and will serve to identify and document sample locations. Grab sample locations will be placed along a center transect of each residential property along the alleyway, three samples will be collected across the alley. Approximately thirty grab samples for the entire block where each transect will be located in the alley at the approximate center of each residential property (see Figure 3-10). The three samples are located at each transect, one in the center and two sides of the alley. The two side locations are about 2 feet from the property line of residences that border the alleyway.

The FPL will identify the actual sampling locations using the map and by placing marker flags at appropriate locations. If obstructions are present at the intended sampling locations, the sample point should be offset so that an alley soil may be collected, then the actual sample location must be correctly documented on the field diagram. All alleyway soil samples will be collected in accord with the Residential Soil Sampling for Yard and Alleyway Soils SOP #ISSI-VBI70-02 Revision 0 (Appendix E). In brief, surface soils (0-2 inches) will be collected at all sample locations. Grab samples will be collected from the 0-2 inch soil horizon approximately 3-6 inches from each marker flag. Each sample will be collected using a clean coring tool (3-inch diameter) (Appendix E). The grab samples will be collected into a ziplock bag and labeled in accord with the Sample Identification and Tracking SOP# ISSI-VBI70-01 Revision 0 (Appendix E).

If disposable sampling equipment is not used during the sampling event, decontamination procedures must be performed before that equipment may be reused. Decontamination must be performed between collection of composite samples in accord with procedures outlined in Section 3.9 and the alley soil sample collection SOP (Appendix E).

Each field team will carry a three-ring binder that holds the VBI70 Alleyway Soil Sample Data Sheets (Figure 3-11). These binders will only contain the paperwork necessary to complete a single day of sampling. One data sheet will be completed for each alley. Any deviations from standard protocols or notable events (e.g., rainy weather, etc.) should be entered in the section for

"Notes". The field team leader will sign the form when sampling is complete and all data are entered onto the form. The field team will not proceed to the next alley until samples are stored in a cooler and paperwork is complete.

At the end of each day of sampling the field teams will return to the Site Office to check-in samples, paperwork and unused sample labels. Samples will be locked and stored under chain-of-custody until they are forwarded for sample preparation and analysis.

### 3.6.2 Field Documentation

Each sampling team will maintain two forms of field documentation. As discussed above, each team will have a binder containing all field data sheets. Additionally, each team will carry a bound field logbook (not three-ring binder). Information contained in this log includes the following:

- Sample date
- Sample team ID
- Names of sample team members
- Weather conditions
- Time sampling begun each day
- Time sampling concluded each day
- Any information that is not limited to a single residence (e.g., deviations to sampling protocols)
- Signature of data logger

This logbook will be maintained daily during sampling activities.

### 3.6.3 Sample Preparation

After samples have been collected, they are submitted under chain-of-custody for sample preparation. Sample preparation will be sieved through a 2 mm screen to prepare a bulk fraction in the same way as yard soils, in accord with the Sample Preparation for XRF Analysis SOP Revision 0 (Appendix E).

At the appropriate frequency (See Section 4.0) or as directed by the FQAC, QC samples such as splits or blind standards are inserted into the sample stream. These samples will be logged into the Field QC Sample Logbook (Figure 3-6) and assigned a sample ID. This document is a bound (not a three-ring binder) logbook maintained by the sample preparation technician. The appropriate sample ID numbers and labels will be checked-out from the FPL. A sample data sheet will be generated for the QC samples in the same manner as for the field samples.

Sample preparation must be performed by a technician who will not perform XRF analysis because samples submitted for XRF analysis must be blind. That is, the sample stream will include both investigative samples as well as blind QC samples. Every effort must be made to maintain sample anonymity.

### 3.6.4 Analytical Method Requirements

Arsenic and lead testing will be performed on all alley soil samples using XRF, providing the chosen XRF methodology can achieve the project-required detection limits (See Section 4.0). A method detection limit study for the chosen instrumentation and proficiency tests for all analysts who will work on the VBI70 Phase III project must be provided to USEPA before analysis of any field samples may proceed. XRF analysis will be performed in accordance with the SOP (Appendix E).

## 3.7 Schools and Parks

Table 2-1 lists all schools and parks within the study area and identifies whether or not they have been sampled yet. As mentioned previously, any schools or parks that have been sampled previously will not be re-investigated during Phase III..

### 3.7.1 Identification and Collection of Soil Samples at Schools and Parks

The specific number and location of samples planned for collection at each school and park included in Phase III field investigations are not summarized here, but will be detailed in an addendum to the Project Plan at a later date. A specific sampling design for each school or park will be prepared to ensure that the sample locations adequately cover each individual property.

All surface soil samples will be collected at schools and parks in accord with the Residential Soil Sampling for Yard and Alleyway Soils SOP #ISSI-VBI70-02 Revision 0 (Appendix E). In brief, surface soils (0-2 inches) will be collected at the frequency specified for each property. The FPL or designate will assigned sampling locations as specified by the addendum and will complete the following activities:

- Draw a field diagram of the property and its major components approximately to scale
- Place marker flags at the property in the approximate specified location

Field Diagram

The FPL will pace off the major attributes of the residence (e.g., dimensions of the property boundary, playground, etc.) and prepare a field diagram to approximate scale (± 5 feet on each measurement). The goal is not have a drawing to scale, but instead to have an estimate of the total samplable area at the property.

Flag Placement in Each Subsection

As discussed previously, sample locations will be identified using marker flags of any three different colors (e.g., red, blue and yellow). The locations of each marker flag should be approximately equidistant from the other flags at the property. Additionally, each color flag should be alternately placed so that same color marker flags are not clustered.

Soil Sampling

Grab samples will be collected from the 0-2 inch soil horizon approximately 3-6 inches from each marker flag of similar color (e.g., red). Each sample will be collected using a clean coring tool (3-inch diameter) (Appendix E). Each grab sample marked by a red flag will be placed into a single ziplock bag and labeled in accord with the Sample Identification and Tracking SOP# ISSI-VBI70-01 Revision 0 (Appendix E). Because property sizes and obstacles present at each residence may vary significantly, actual sample locations will be identified using a diagram that will be drawn for each individual property sampled. If obstructions are present at the intended sampling locations (e.g., sidewalk), the sample point should be offset so that a surficial soil may be collected, then the actual sample location must be correctly documented on the field diagram. Other composite samples will be collected in an identical fashion but by sampling next to the blue and yellow flags, respectively.

If disposable sampling equipment is not used during the sampling event, decontamination procedures must be performed before that equipment may be reused. Decontamination must be performed between collection of composite samples in accord with procedures outlined in Section 3.9 and the soil sample collection SOP (Appendix E).

Each field team will carry a three-ring binder that holds the VBI70 Soil Sample Data Sheets (Figure 3-4). These binders will only contain the paperwork necessary to complete a single day of sampling. One data sheet will be completed for each school or park, since the data recorded at each property are applicable to each of the three composites collected at that property. Any deviations from standard protocols or notable events (e.g., rainy weather, etc.) should be entered in the section for "Notes". The field team leader will sign the form when sampling is complete and all data are entered onto the form. The field team will not proceed to the next property until samples are stored in a cooler and paperwork is complete.

At the end of each day of sampling the field teams will return to the Site Office to check-in samples, paperwork and unused sample labels. Samples will be locked and stored under chain-of-custody until they are forwarded for sample preparation and analysis.

### 3.7.2 Field Documentation

Each sampling team will maintain two forms of field documentation. As discussed above, each team will have a binder containing all field data sheets. Additionally, each team will carry a bound field logbook (not a three-ring binder). Information contained in this log includes the following:

- Sample date
- Sample team ID
- Names of sample team members
- Weather conditions
- Time sampling begun each day
- Time sampling concluded each day
- Any information that is not limited to a single property (e.g., deviations to sampling protocols)
- Signature of data logger

This logbook will be maintained daily during sampling activities.

### 3.7.3 Sample Preparation

After composite soil samples have been collected, they will be submitted under chain-of-custody for sample preparation. Sample preparation will be performed in accord with the Sample Preparation for XRF Analysis SOP Revision 0 (Appendix E).

<u>Preparation of Bulk Samples</u>

In brief, all composite samples from the field (referred to as "raw" field samples) will be air-dried and sieved to remove material larger than 2 mm using a #10 stainless steel sieve. The entire mass of each entire raw sample will be sieved in this way. Any material not passing through the 2 mm sieve will be disposed of as IDW. After sieving, the sample passing the sieve (now referred to as the "bulk" sample) is placed into a new ziplock bag that is labeled with the original sample ID number, except that the suffix is "B" (for bulk) rather than "R" (for raw). From this bag, a 10-g sample is removed and placed in a new ziplock bag, labeled with the sample ID (suffix = R) and forwarded to the XRF analyst for testing. A record of all air-drying and sieving procedures must be documented in the Field Sample Preparation Logbook (Figure 3-5). Information such as the sample ID, date of sample preparation, sieve size and the duration of air drying will be included in the log.

Preparation of Fine Samples

Selected bulk samples will be identified for a second sieving step in order to isolate a fraction of fine particles for analysis. This step will be performed to confirm expectation that arsenic and lead levels are not significantly different in the bulk and fine fractions. This step will be performed for about 60-90 residences. These residences will be selected so that soil concentrations span the range of reported metals concentrations.

The fine sample is prepared by removing a portion of the bulk sample (about 100 g) and sieving through a #60 stainless steel sieve. After sieving, the material that does not pass through the screen is disposed of as IDW, and the material that does pass through the screen is placed into a new ziplock bag labeled with the original sample ID number and the suffix "F" (for fine). A 10-g portion of the fine material is removed and placed in a new ziplock bag, labeled with the sample ID (suffix = F) and forwarded to the XRF analyst for testing.

Decontamination

If disposable sieves or other equipment are not used during sample preparation, decontamination procedures must be performed before the tools or equipment may be reused. Decontamination must be performed between samples sieved in accord with procedures outlined in Section 3.9 and the sample preparation SOP (Appendix E).

QA/QC Samples

At the appropriate frequency (See Section 4.0) or as directed by the FQAC, QC samples such as splits or blind standards are inserted into the sample stream. These samples will be logged into the Field QC Sample Logbook (Figure 3-6 and 3-7) and assigned a sample ID. This document is a bound (not a three-ring binder) logbook maintained by the sample preparation technician. The appropriate sample ID numbers and labels will be checked-out from the FPL.

Sample preparation must be performed by a technician who will not perform XRF analysis because samples submitted for XRF analysis must be blind. That is, the sample stream will include both investigative samples as well as blind QC samples. Every effort must be made to maintain sample anonymity.

### 3.7.4 Analytical Method Requirements

Arsenic and lead testing will be performed on all soil samples using XRF, providing the chosen XRF methodology can achieve the project-required detection limits (See Section 4.0). A method detection limit study for the chosen instrumentation and proficiency tests for all analysts who will work on the VBI70 Phase III project must be provided to USEPA before analysis of any field samples may proceed. XRF analysis will be performed in accordance with the SOP (Appendix E).

## 3.8 Sample Identification

Every field and QC sample collected during this investigation will be identified with a unique sample identification number (sample ID). The sample ID consists of 3 elements as described below. Complete details about the sample ID are provided in the Sample Identification and Tracking SOP ISSI-VBI70-01 Revision 0 (Appendix E).

PHASE. All labels will begin with the number "3" to indicate that the sample is derived from Phase III of the study.

NUMBER. Each label will include a unique identification number. This number will be a 5-digit sequential number starting with "00001" and progressively increasing until the final sample has been collected or tag number "99999" has been reached.

SAMPLE PREPARATION. Samples will be categorized based upon the sample preparation performed. Categories include, but are not limited to the following. The sample preparation nomenclature may be expanded as needed in the future providing they are approved by the Project Database Manager or designate.

R Raw sample. Original sample collected during Phase III which is unprocessed.

B Bulk fraction. The bulk soil fraction (sieved to < 2 mm).

F Fine fraction. The fine soil fraction (sieved to < 250 µm).

Thus, "3-00001-R" and "3-12846-F" represent possible sample numbers collected during Phase III. This type of sample ID is not "self-reading" (the sample location or QC type cannot be interpreted by reading the sample ID) and has been designed so that sample anonymity may be maintained through laboratory analysis.

## 3.9 Sample Handling and Custody Requirements (B3)

At the end of each day, the field team returns the samples and the data sheets to the FPL who reviews the forms for completeness and accuracy. If no omissions are noted, the field team is free to leave for the day. If problems are noted, these must be resolved and corrected before the team leaves the site. If corrections are made to the field notes or data sheets, the field team member will draw a single line through the mistake and initial and date the correction. When the forms are complete and accurate, the FPL signs and dates the forms. All forms are placed in a three-ring binder (the Master Field Logbook) in numerical order by sample ID. One placed into the Master Field Logbook, the forms are immediately paginated (sequentially numbered). Data from the data collection forms are entered into the project database in accord with procedures outlined in the DMP (Section 5.0).

Samples must be kept under strict chain-of-custody at all times. Chain-of-custody (COC) procedures are outlined in the attached SOPs (Appendix E). An example COC form is provided as Figure 3-12.

## 3.10 Decontamination Procedures

Decontamination is defined as physically removing inorganic contaminants and foreign material (e.g., dust, oil, detergent) or altering their chemical character to nonreactive/inert substances. All sampling devices and equipment (e.g., tubing, nozzles, coring tools) that are planned for use to collect samples at more that one location must be decontaminated prior to reuse. Therefore, decontamination (decon) procedures must be rigorously followed to minimize the potential for cross-contamination of samples.

All decon procedures shall be performed at a designated decontamination area. This area should be chosen such that environmental factors (e.g., cross-winds, drafts, dust) are minimized. Decon procedures will be performed in accord with the Decontamination Procedures SOP (Appendix E).

## 3.11 Sample Archives

All surface soil and dust samples collected during Phase III must be retained in a dry and secure (locked with limited access) storage facility for 6 months after the last sample has been collected from the study area. A portion of samples may be identified for further characterization; therefore samples must be stored in an organized manner such that quick retrieval is possible. All investigative samples will be held in storage, under chain-of-custody until the Remedial Project Manager (RPM) indicates that these samples may be disposed according to proper waste disposal methods.

## 3.12 Health and Safety

The contractor implementing this project plan will be responsible for providing and instituting an approved Health and Safety Plan (HASP) for this site. The HASP must contain a discussion of safety procedures for topics including but not limited to reduction in slips, trips and falls; personal protective equipment (PPE) that is appropriate for all aspects of the investigation; training and certifications required for each activity; and measures for how to deal with contamination of known and unknown composition, if encountered.

## 3.13 Waste Generation and Management

Any waste is generated as a result of this investigation must be disposed in accord with Federal, State and local regulations. The contractor generating the waste is responsible for proper management and disposal. See Appendix E for Investigation Derived Waste (IDW) protocols.

# 4.0 QUALITY ASSURANCE PROJECT PLAN

This Quality Assurance Project Plan has been prepared in accordance with USEPA guidance documents and presents a specific quality assurance and quality control (QA/QC) program required to ensure that the results of the field investigation satisfy project requirements (USEPA 1994a, 1996, 1998). This section summarizes activities required to ensure that all technical, operational, monitoring and reporting activities are of the highest achievable quality. Sections that are recommended for inclusion (by USEPA guidance) in this portion of the project plan, but that have been presented in previous sections of the document are cross-referenced in this section for clarity and convenience.

## 4.1 Project Task And Organization (A4)

### 4.1.1 Project Task (A4)

Project background, study objectives and tasks are summarized in Section 1.0.

### 4.1.2 Project Organization (A4)

Key USEPA personnel and the contractors who will participate in operations planned for development, implementation, oversight and interpretation of data generated from the Phase III field investigation are presented in Section 1.0.

## 4.2 Problem Definition and Background (A5)

Project background and problem definitions are presented Sections 1.0 and 2.0, respectively.

## 4.3 Project Task Description and Schedule (A6)

Project task description including study goals are presented in Sections 1.0 and 2.0. A schedule of planned activities is will be included in the final project plan.

## 4.4 Data Quality Objectives (A7)

The DQO process for the overall study objectives for each of the three components presented in this Project Plan is outlined in Section 2.0. DQO requirements that ensure data of sufficient quality are obtained during this investigation are presented in the following section.

### 4.4.1 Criteria for Measurement Data (A7)

The performance criteria for measurement data generated as part of this project will be evaluated in terms of precision, accuracy, representativeness, completeness and comparability (PARCC). The following sections describe PARCC criteria.

Precision: Precision is defined as the agreement between a set of replicate measurements without assumption or knowledge of the true value. It is a measure of agreement among individual measurements of the same attributes under prescribed similar conditions (e.g., split samples of a residential composite soil). Agreement is expressed as the relative percent difference (RPD) for duplicate measurements if the reported values are sufficiently above the method detection limit (MDL) (> 5 x MDL) or the absolute difference of two values near the MDL (≤5 x MDL). Where:

$$RPD = \frac{|2\,(A - B)|}{A + B} \times 100\%$$

$$\text{Absolute difference} = |\,A - B\,|$$

Where:

A = original concentration value of an analyte
B = duplicate concentration value of an analyte

Accuracy: Accuracy is a measure of the closeness of individual measurements to the "true" value. Accuracy usually is expressed as a percentage of that value. For a variety of analytical procedures, standard reference materials traceable to or available from National Institute of Standards and Technology (NIST) or other sources can be used to determine accuracy of measurements. Specific accuracy guidelines for other accuracy measurements such as calibration verification standards are summarized in Table 4-1. Additionally, criteria are detailed in the individual SOPs or methodologies provided in Appendix E. Accuracy will be measured as the percent recovery (%R) of an analyte.

$$\%R = \frac{A}{B} \times 100\%$$

Where:

A = measured concentration value of an analyte
B = true (known) concentration value of an analyte

Representativeness: Representativeness is defined as the degree to which data accurately and precisely describe the general characteristics of a population or the parameter variations at a sampling point. It is important to determine whether samples collected for this investigation are representative at both levels and are presented in Section 2.0

Comparability: Data are comparable if collection techniques and measurement procedures are equivalent for the samples within a sample set. Comparable data will be obtained by specifying standard units for physical and chemical measurements and standard procedures for sample collection, processing, and analysis. See the attached SOPs (Appendix E) for sampling and for analytical procedures.

Completeness: Data are considered complete when a prescribed percentage of the total measurements and samples that are planned are actually obtained.

> *Collection of Soil data*: The overall goal of the study is to obtain soil data from all residential properties in the study area that have not previously been sampled. However, it is expected that not all property owners will grant authorization to sample at their property. Because the participation rate cannot be predicted, a pre-determined completeness goal for this aspect of the project can not be prescribed. All attempts to acquire access (participation) must be carefully documented and data gaps encountered and the potential impact of the gaps will be discussed in the report detailing findings (Section 4.2.2). However, for properties to do grant authorization to sample, the completeness goal is 100% (i.e., samples will be collected at all properties granting authorization). Within each property that grants authorization, completeness is defined as collection of the specified set of soil samples (3 composites of 10 each).

> *Analytical Data Produced by Laboratories*: Analytical data must be valid for at least 90% of analyzed samples. This means that fewer than 10% of all analytical data generated for each analytical method may incur a qualification of unusable (R qualification). If this completeness goal is not met, the analytical laboratory responsible for generating the poor quality data must reanalyze samples without additional cost and reanalyses must adhere to method requirements to generate valid data.

## 4.5 Special Training Requirements and Certification (A8)

Personnel responsible for completing this project include, but are not limited to: toxicologists, chemists, geologists, statisticians, field samplers, data managers and GIS specialists. These technically-trained personnel have been chosen to participate in the investigation because they are experienced in conducting sampling programs, chemical measurements on a variety of analytical instrumentation and performing interpretation of data generated from the sampling program. Each person working on this project is responsible for attaining and maintaining appropriate training commensurate with their area of expertise.

At least one member of each sampling team as well as all supervisory personnel retained for field sampling activities must be OSHA HAZWOPER (Occupational Safety and Health Administration Hazardous Waste Operations and Emergency Responder) certified. Field sampling personnel must also be familiar with the information contained in the project plan and must ensure that all project requirements for sampling are met. Likewise, all analysts must be familiar with the project plan and must ensure that all project requirements for sample preparation and analysis are met. Prior to collection and/or analysis of any samples, each team member participating in the field investigations must attend a "readiness review" and must show auditors that he or she is familiar with and has a clear understanding of all procedures and protocols for which that person is responsible.

Each member of the sampling team must sign that he has received a copy, read and understood the Health and Safety Plan (HASP) prior to initiation of field activities. The Health and Safety Officer (HSO) must keep all signatures on file.

## 4.6 Documentation and Records (A9)

Maintenance of pertinent documentation is critical for evaluating the success of the investigation. This section describes the laboratory requirements for preparing data packages for this project. In addition, procedures for storing and maintaining laboratory data are described in this section. Documentation describing sample handling and custody requirements are discussed in Section 3.7 of this Project Plan.

### 4.6.1 Field Data (A9)

Field documentation procedures are outlined in Section 3.0, the FSP.

### 4.6.2 Laboratory Data (A9)

Contract Laboratory Program (CLP)-like data packages will be required for all laboratory analytical data. These CLP-like data packages will include a case narrative, copies of all associated raw data, sample results and all associated QC summaries. A summary of the data package requirements is shown on the next page:

Section I **Case Narrative**

A. Case narrative
B. Copies of nonconformance/corrective action forms
C. Copies of sample receipt notices
D. Internal tracking documents, as applicable
E. Copies of all chain-of-custody forms

Section II **Analytical Results** - All results will be reported on a dry weight basis.

A. Results for each parameter including dilutions and reanalysis (dry-weight basis)
B. Units of measure
C. Method Quantitation Limit
D. Date of sample analysis
E. Date of sample receipt
F. Date of sampling
G. Dilution factor

Section III **QA/QC Summaries**

A. Method blanks, continuing calibration blanks, preparation blanks, instrument blanks
B. Initial and continuing calibration verifications
C. ICP-MS interference check samples
D. Matrix spikes and post-digestion spikes
E. Method duplicate samples
F. Laboratory control samples
G. Method of standard additions
H. ICP-MS serial dilution
I. Instrument detection limits

Section IV **Instrument Raw Data** – Sequential measurement readout records for XRF, ICP-MS, GFAA, which will include the following information (as applicable):

A. Environmental samples, including dilutions and reanalyses
B. Initial calibration (including reporting whether $r^2 \geq 0.995$)
C. Initial and continuing calibration verifications
D. Method blanks, continuing calibration blanks and preparation blanks
E. ICP-MS interference check samples
F. Matrix spike and post-digestion spikes
G. Matrix duplicate samples
H. Laboratory control samples
I. Method of standard additions
J. ICP-MS serial dilution

Section V **Other Raw Data**

A. Sample digestion and preparation logs
B. Instrument analysis logs for each instrument used
C. Standard preparation logs, including initial and final concentrations for each standard used

Section VI **Electronic Data** – All analytical data will be supplied in electronic form as well as hardcopy form. All data will be provided as outlined in the DMP (Section 5.0).

### 4.6.3 Data Management (A9)

A complete discussion of data management procedures is provided in the DMP (Section 5.0).

## 4.7 Measurement And Data Acquisition (B)

This section describes the site investigation design and implementation, including method for sample collection, handling and analysis. In addition, field and laboratory QC procedures and instrument testing, inspection, maintenance and calibration requirements are described. The information for Section B1 through B4 has been outlined in the FSP (Section 3.0).

## 4.8 Quality Control Requirements (B5)

The principal objectives of any sampling and analysis program are to obtain accurate and representative environmental samples and to provide valid analytical data. The quality of data will be assessed through the use of QC samples analyzed on a regular basis. Laboratory QC samples will be analyzed as per analytical method protocols to evaluate whether laboratory procedures and analyses have been completed properly. For this project, the types of QC samples to be analyzed are defined and their role in the production of QC data are discussed in the following sections. In addition to the particular QC requirements identified in the subsequent sections, all analyses must be performed within holding times and must adhere to all procedures as outlined in the appropriate SOPs (Appendix E).

### 4.8.1 Field Quality Control Samples (B5)

Field Splits: Field split samples are two aliquots of the same sample that has been prepared blind to the analyst only after the original sample has been properly prepared (air-dried, sieved and homogenized). These samples are submitted blind to the laboratory to measure the precision of laboratory preparation and analysis. Field splits are required to be collected at a frequency of 5% of all surface soil samples collected (1 field split per 20 investigation samples collected for about 150 total splits). The RPD for field splits should not exceed 20% or, alternatively, the absolute difference should not exceed 1 x MDL. However, these acceptance limits may be arbitrary; therefore, a graphical comparison of the original and field split samples should also be prepared. This comparison will include a linear regression and will report the calculated correlation coefficient (r). Field splits will be prepared for surficial soil samples at residential properties, schools and parks.

Field Duplicates: Field duplicate samples are co-located samples that are collected at the site. These samples are submitted blind to the laboratory to test both the precision of the laboratory analysis and the precision of sample collection. Field duplicates are required to be collected at a frequency of 5% of all surface soil samples collected (1 field duplicate per 20 investigation samples collected). The RPD for field duplicates should not exceed 20% or, alternatively, the absolute difference should not exceed 1 x MDL. However, these acceptance limits may be arbitrary; therefore, a graphical comparison of the original and field duplicate samples should also be prepared. This comparison will include a linear regression and will report the calculated correlation coefficient (r). Field duplicate samples will be collected for alley surface soil samples only.

Field Blank: A field blank is a sample composed of the same media as corresponding field samples. A field blank is exposed to the field conditions in order to determine whether introduction of target analytes occurred during sampling. One field blank will be collected at a frequency of 5% (1 field blank per 20 indoor dust samples collected). Concentrations of target analytes greater then 1 x MDL may suggest that field sampling-induced contamination may have occurred. This sample will only be collected for indoor dust samples.

Equipment Rinsate Blank: An equipment rinsate blank is a sample composed of a rinse of equipment that has been decontaminated after use and must be performed at a frequency of 5% of all decontaminations performed on each type of equipment. Concentrations of target analytes greater than 1 x MDL for most analytes and 5-10 x MDL for laboratory-induced contaminants may suggest that field sampling-induced contamination may have occurred. This sample will only be collected if decontamination is required. If all field sampling and preparation equipment is disposable (one-use only), then equipment blanks are not collected.

Blind Standard: The accuracy of an analytical method is evaluated by analyzing a sample medium fortified with a known concentration of target analytes that has been certified using the preparation and analysis method for that particular sample medium. This sample is submitted to the laboratory blind at a frequency of about 0.1% (about 30 samples) for each level. About 3 concentrations levels of blind standards should be available. The accuracy requirements will be provided by the certifying laboratory. Recoveries will also be monitored using control charting. Control charting will be performed in accord with standard USEPA protocols and will be used to establish site-specific performance criteria.

### 4.8.2 Laboratory Quality Control Samples (B5)

Matrix Spike: A matrix spike sample is an investigative sample having a matrix that is representative of all investigative samples to which a known concentration of target analytes is added. This quality control sample measures the extent that the sample matrix affects the accuracy of reported target analytes and must be performed at a frequency of 5% of all investigative samples prepared for analysis (1 matrix spike for every 20 investigative samples) or 1 per preparation batch, whichever is more frequent. Accuracy requirements are summarized in Table 4-1.

Laboratory Control Sample (LCS): A LCS originates in the laboratory or is provided as a standard reference material (SRM) by a manufacturer (eg. NIST) and contains target analytes of known concentration. Because LCSs are independent of the calibration standards, they are analyzed to verify the accuracy of the standards used to calibrate the instrument. A LCS must be performed at a frequency of 5% of all investigative samples prepared for analysis (1 LCS for every 20 investigative samples ) or 1 per preparation batch, whichever is more frequent. The LCS must fall within manufacturer's certified acceptance limits. Specific accuracy requirements are summarized in Table 4-1.

Laboratory Duplicates: Laboratory duplicates are splits that are prepared in the laboratory. Because the laboratory is aware that the samples are duplicates, these samples serve to test the precision of the laboratory's sample preparation and analysis. A laboratory duplicate must be performed at a frequency of 5% of all investigative samples prepared for analysis (1 laboratory duplicate for every 20 investigative samples) or 1 per preparation batch, whichever is more frequent. The RPD for laboratory duplicates should not exceed 20% or, alternatively, the absolute difference should not exceed 1 x MDL.

Instrument Blanks: An instrument blank is composed of the reagents, solvents or matrix of investigative sample following sample preparation and are used to discern if laboratory-induced contamination is present. These samples must be inserted in the analysis stream at a frequency of 5% of samples at minimum. If contamination is present or suspected, the frequency of these samples is increased as necessary (See Section 4.12.1.2 Corrective Action Procedures). Concentrations of target analytes greater than 1 x MDL for most analytes and 5-10 x MDL for laboratory-induced contaminants may suggest that laboratory-induced contamination may have occurred. Corrective actions must take place prior to analysis of investigative samples.

Confirmation Samples: In accord with USEPA guidelines (SW-846 Method 6200), the analytical results measured by the XRF must be confirmed using another methodology (ICP-MS or GFAA) and performed by an independent laboratory. Confirmation analyses will be performed on 10% of surface soils collected during Phase III. A graphical comparison of the XRF analysis and the corresponding ICP-MS or GFAA metals analysis should also be prepared. This comparison will include a linear regression and will report the calculated correlation coefficient (r). These samples will include residential and alley soils.

## 4.9 Method Detection Limits (B5)

MDLs are defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the true value is greater than zero. The MDLs required for each analytical methodology planned for this investigation are summarized below.

**Table 4-1 Method Detection Limits Required for Phase III Investigations**

| | | Method Detection Limits | | | |
|---|---|---|---|---|---|
| | | Arsenic | | Lead | |
| Instrumentation | Methodology | mg/L | mg/kg | mg/L | mg/kg |
| XRF | SOP-MK | – | 20 | -- | 20 |
| ICP-MS | USEPA SW-846 6020 | 0.5 | 1.0 | 1 | 5 |
| GFAA | USEPA SW-846 7060 (Arsenic) and 7421(Lead) | 0.5 | 1.0 | 1 | 5 |

– Not applicable
XRF - X-ray fluorescence
ICP-MS - Inductively Coupled Plasma-Mass Spectrometry
GFAA - Graphite Furnace Atomic Absorption

## 4.10 Instrument/Equipment Testing, Inspection and Maintenance Requirements (B6)

Field equipment planned for use during this investigation are a fixed-based XRF. This instrument will be inspected daily to ensure it remains in good working condition. Specific details about instrument inspection and maintenance is provided in the XRF SOP. All information relating to the daily instrument inspection, calibration and maintenance will be documented in a field logbook.

Laboratory equipment planned for chemical analysis during this investigation must be inspected daily to ensure it remains in good working condition. Any maintenance that is performed on the instruments must be document in the respective instrument maintenance logbooks. The logbooks must remain on file accessible at the analytical laboratory for 5 years after analysis of Phase III samples.

## 4.11 Instrument Calibration and Frequency (B7)

Instrument calibration of field equipment will be performed daily (prior to initiation of analyses) in accord with procedures outlined in the respective SOPs. Calibration of the XRF will include measurement of at least 3 different levels of NIST-certified soil standards. Measurements of calibration standards must be within two times the certified standard deviation of the mean for each target analyte. Analysis of investigative samples may not begin until measurements of certified standards are within performance limits.

Laboratory instrumentation, used for sample analyses, will be calibrated in accordance with the SOPs or recommended USEPA methodologies. Calibrations must be acceptable before any measurements on investigative samples may be made. Traceable calibration standards will be obtained by the analytical laboratories. All documentation relating to receipt, preparation and use of standards will be recorded in the appropriate laboratory logbooks. This information will be forwarded as part of the raw analytical data package as described in Section 4.6.2.

## 4.12 <u>Assessment and Oversight</u> (C)

The following sections describe activities for assessing the effectiveness of the implementation of the project and associated QA/QC. The purpose of the assessment is to ensure that the project plan is implemented as prescribed. The elements include assessments and response actions and reports to management as described in the following sections.

### 4.12.1 Assessment and Response Actions (C1)

#### 4.12.1.1 Audits (C1)

Assessment of field activities and laboratory analyses will be conducted through oversight of analytical procedures through field and laboratory audits. The purpose of the oversight (audit) activities will be to document field sampling and analysis procedures, to determine if activities are proceeding in accord with project requirements and to document any changes, additions or deletions that have occurred during field sampling and analysis and to identify and immediately implement any corrective actions.

Field audits will evaluate laboratory procedures to ensure that activities are proceeding in accord with the project plan.

Laboratory audits will evaluate laboratory procedures to ensure that they follow Good Laboratory Practices (GLP) Guidelines and to ensure that they do not conflict with project requirements. If conflicts are noted, these must be addressed so that project requirements are met. Additionally, laboratory analyses may also be assessed through submittal of performance evaluation (PE) samples. PE samples may be used as a tool for evaluating the accuracy of laboratory analyses. PE samples are standards submitted blind to the laboratory and are typically submitted prior to submittal of investigative samples. The concentration is unknown to the laboratory analyzing the sample, but known to the submitter. The laboratory reported results for the PE samples will be evaluated by comparison to the certified values provided by the contractor providing field and laboratory oversight (ISSI).

Other audits that will be carried out include an evaluation of the flow of electronic and hard copy data. Audits will review the data flow, verify data entry procedures and evaluate whether data management QC protocols are being observed.

If audits resulting from review of any of the procedures reveal that project requirements are not met, then corrective action for the deviation must be requested, reviewed and reported. Results for all audits must be documented and submitted to the USEPA Remedial Project Manager. Information in the report includes:

- Type of System Audit (Field, Laboratory, Data Management, etc.)
- Date of audit
- Summary of procedures reviewed
- Results of the review/audit including any non-conformances noted
- Corrective Action Request(s) [CAR], if non-conformance noted
- Date by which CAR must be received with response

If a CAR is required, a follow-up audit must be performed withing 5 working days upon receipt of the CAR to ensure that corrective actions were implemented. A Follow-up audit report describing the new findings must be submitted to the USEPA RPM. More detailed information regarding corrective action procedures is provided in the next section.

#### 4.12.1.2 Corrective Action Procedures (C1)

Two types of corrective actions may result from audits and/or oversight: immediate and long-term. Immediate corrective actions include correcting deficiencies or errors or correcting inadequate procedures. Long-term corrective actions are designed to eliminate the sources of deficiencies or errors. If either type of corrective action is deemed necessary following an audit, each step in the following procedures must be documented:

- Identify the deviation
- Request a corrective action
- Report the problem the USEPA RPM
- Review the corrective action response
- Perform a follow-up audit to ensure the deviation is not recurring

Appropriate corrective action procedures for specific laboratory or field quality control samples are outlined in the subsequent paragraphs. Refer to Table 4-2 for recommended corrective action.

**Table 4-2 Required Quality Control and Recommended Corrective Action for Phase III Investigations**

| QC Performed | Sample Matrix | Minimum Frequency | Acceptance Criteria | Recommended Corrective Action |
|---|---|---|---|---|
| Blind Standard | Residential, Alley, School and Park Soils and Indoor Dust | 90 samples (30 samples for each spike level)<br><br>About 3 concentrations levels of blind standards will be available. | Accuracy requirements will be provided by the certifying laboratory.<br><br>Recoveries will also be monitored using control charting. Control charting will be performed in accord with standard USEPA protocols and will be used to establish site-specific performance criteria. | Verify the percent recovery calculations. If calculations are correct, the FQAC will request the analyst to reanalyze the sample. If reanalysis results are still outside of acceptance limits, submit another blind standard immediately into the sample stream to determine if the analysis shows a trend or an isolated event. *Analysis of site samples may be discontinued until the problem is resolved.* |
| Confirmation Samples | Residential, Alley, School and Park Soils | 10% of surface soils | A graphical comparison of the XRF analysis and the corresponding ICP-MS or GFAA metals analysis should also be prepared. This comparison should include a linear regression with the calculated correlation coefficient (r). R should be >0.9. | Investigate the source of the discrepancy between chemical measurements if greater than 25% different. |
| Continuing Calibration Blank | Residential, Alley, School and Park Soils and Indoor Dust | every 10 samples in the analytical batch (before the CCV) | < 1 x MDL | Evaluate instrument or system, locate source of contamination, and perform a system blank to determine if the system blank meets acceptance criteria. Continue to perform system blanks until acceptance criteria are met. *Reanalyze the blank and associated investigative samples.* |
| Continuing Calibration Verification | Residential, Alley, School and Park Soils and Indoor Dust | every 10 samples in the analytical batch (after the CCB) | 90-110% recovery of known value | Verify the percent recovery calculations. If calculations are correct, evaluate the standard to determine if it is faulty. If it is, prepare a new standard and reanalyze the CCV and all associated investigative samples. If necessary, recalibration the instrument. *Do not continue analysis until the problem is solved.* |

| QC Performed | Sample Matrix | Minimum Frequency | Acceptance Criteria | Recommended Corrective Action |
|---|---|---|---|---|
| Equipment Blank | Residential, Alley, School and Park Soils and Indoor Dust | 5% of all decontaminations performed on each type of equipment | target analytes <1 x MDL;<br>5-10 x MDL for laboratory-induced contaminants | Suggests that field sampling-induced contamination may have occurred. Evaluate all associated QC samples. If all other QC samples are within prescribed acceptance limits, but the equipment blank is not (e.g., positive identifications of target analytes are observed), *contact the USEPA immediately to determine whether resampling and/or reanalysis is required.* |
| Field Blank | Indoor Dust | 5% (1 field blank per 20) | target analytes < 1 x MDL | Suggests that field sampling-induced contamination may have occurred. Investigate the source of induced contamination and *contact the USEPA immediately to determine whether resampling and/or reanalysis is required.* |
| Field Duplicates | Alley Soils | 5% of all surface soil samples<br>(1 field duplicate per 20) | RPD < 20% or,<br>the absolute difference should not exceed 1 x MDL.<br><br>A graphical comparison of the original and field duplicate samples should also be prepared. This comparison will include a linear regression and will report the calculated correlation coefficient (r). R should be >0.9. | Verify the RPD calculation. If this is correct, determine if matrix interference or heterogeneous samples are factors in the poor RPD. If matrix effects or heterogeneous samples are not observed, reanalyze the method duplicate and associated investigative samples. *If appropriate, re-extract or redigest and reanalyze the method duplicate and associated investigative samples.* |
| Initial Calibration Blank | Residential, Alley, School and Park Soils and Indoor Dust | beginning of each run or beginning of every new shift (whichever is more frequent)<br>(before the ICV) | < 1 x MDL | Evaluate system, locate source of contamination, and perform a system blank to determine if the system blank meets acceptance criteria. Continue to perform system blanks until acceptance criteria are met. *Do not begin analysis of investigative samples until criteria are met.* |
| Initial Calibration Verification | Residential, Alley, School and Park Soils and Indoor Dust | beginning of each run or beginning of every new shift (whichever is more frequent)<br>(after the ICB) | 90-110% recovery of known value | Verify the percent recovery calculations. If calculations are correct, evaluate the standard to determine if it is faulty. If it is, prepare a new standard and reanalyze the ICV and all associated investigative samples. If necessary, recalibration the instrument. *Do not continue analysis until the problem is solved.* |

| QC Performed | Sample Matrix | Minimum Frequency | Acceptance Criteria | Recommended Corrective Action |
|---|---|---|---|---|
| Laboratory Control Sample (LCS) | Residential, Alley, School and Park Soils and Indoor Dust | 5% or 1 per batch (whichever is more frequent) | must be within manufacturer's established acceptance limits. | Verify the percent recovery calculations. Evaluate the standard to determine if it is faulty. If it is, prepare a new standard and reanalyze the LCS and associated investigative samples. If necessary, recalibrate the instrument. *Do not continue analysis until the problem is solved.* |
| Matrix Spike | Residential, Alley, School and Park Soils and Indoor Dust | 5% or 1 per batch (whichever is more frequent) | 75-125% spiked sample recovery (spiking level plus original sample level) | Verify the matrix spike percent recovery calculations and evaluate the LCS percent recoveries. If the calculations are correct and the LCS recoveries are acceptable, determine if matrix interference is a factor in the poor recoveries. If matrix effects are not observed, reanalyze the matrix spike and associated investigative samples. *If appropriate, re-extract or redigest and reanalyze the matrix spike and associated investigative samples.* |
| Method Blank | Residential, Alley, School and Park Soils and Indoor Dust | 5% or 1 per batch (whichever is more frequent) | < 1 x MDL except for common laboratory contaminants which may be 5-10 x MDL | Evaluate instrument, locate source of contamination, perform system blanks to confirm that the system blank meets performance criteria. Re-analyze method blank and associated samples. *If method blank is still positive, re-extract or redigest the method blank and all associated samples.* |
| Method Duplicate | Residential, Alley, School and Park Soils and Indoor Dust | 5% or 1 per batch (whichever is more frequent) | RPD < 20% | Verify the RPD calculation. If this is correct, determine if matrix interference or heterogeneous samples is a factor in the poor RPD. If matrix effects or heterogeneous samples are not observed, reanalyze the method duplicate and associated investigative samples. *If appropriate, re-extract or redigest and reanalyze the method duplicate and associated investigative samples.* |
| Post-digestion Spike | Residential, Alley, School and Park Soils and Indoor Dust | as required; if matrix spike does not meet acceptance criteria | 85-115% recovery of post-spiked sample | Verify the percent recovery calculations. If these are acceptable and the spike addition produces a minimum level of 10 times to a maximum of 100 times the instrument detection limit (IDL), matrix effects should be suspected. No further action is required. |

| QC Performed | Sample Matrix | Minimum Frequency | Acceptance Criteria | Recommended Corrective Action |
|---|---|---|---|---|
| System Blank | Residential, Alley, School and Park Soils and Indoor Dust | as required; if other blank samples are not meeting acceptance criteria | < 1 x MDL | Continue to perform system blanks until acceptance criteria are met. |

MDL - Method Detection Limit
RPD - Relative Percent Difference

## 4.13 Data Validation And Useability(D)

The following sections describe the requirements and methods for data review, validation and verification. In addition, the process for reconciling the data generated with the requirements of the data user is also defined.

### 4.13.1 Data Review Validation and Verification (D1)

The process of data review, validation and verification is intended to provide consistent and defensible analytical results. Analytical data generated as part of this project will be reviewed and verified before they are incorporated into the project database. Full data validation will be completed on approximately 10% of the data generated for this project. Abbreviated validation will be completed on all other analytical data. Abbreviated and full data validation criteria are described in Section 4.1.1. Full data validation will be performed in accordance with *USEPA National Functional Guidelines for Inorganic Data Review* (USEPA 1994b) and the *USEPA National Functional Guidelines for Organic Data Review* (USEPA 1994c). Abbreviated validation will utilize these guidelines as they pertain to the components outlined in Section 4.1.1.

### 4.13.2 Validation and Verification Methods (D1)

<u>Full Validation</u>: Full validation will be conducted on data packages for 10% of the samples submitted for chemical analysis. This will be performed to ensure that data were produced in accord with procedures outlined in this project plan. The following elements will be reviewed for compliance as part of the full data validation:

- Methodology
- Holding Times
- Calibration
- Blanks
- Spikes
- Duplicates
- LCSs
- Practical Quantitation Limits
- Analyte Identification
- Analyte Quantification

<u>Abbreviated Validation/Verification</u>: Abbreviated validation will be completed on 100% of the analytical results for which full validation was not performed (the remaining 90% of analytical results). This will be performed to ensure that data were produced in accord with procedures outlined in this project plan. The following elements will be reviewed for compliance as part of

the abbreviated data validation:

- Methodology
- Holding Times
- Calibration
- Blanks
- Spikes
- Duplicates

## 4.14 Final Reporting

Data reporting consists of communicating summarized data in a final form. QA for reporting consists of measures intended to avoid or detect human error and to correct identified errors. Such methods include specification of standard reporting formats and contents of measures to reduce data transcription errors.

Laboratory Reports: All raw data and analytical results will be provided by the commercial laboratory. This information will be incorporated into a final report which will be provided in both hardcopy and electronic forms. Copies (hardcopy and electronic) of the raw analytical data packages will be submitted to USEPA for archival. More information regarding data management is provided in Section 5.0.

Study Report: A draft report of all the summary study design characteristics, sample analyses, data quality, correlation results and resulting field and analytical data shall be presented by the prime contractor in both hardcopy and electronic forms. Additionally, the electronic database will also be provided to the USEPA. Simple statistical tests of group treatment differences will be performed and presented as discussed in Section 2.0. This report will undergo technical review by USEPA. If necessary, comments to the draft report will be provided to the prime contractor and a final report will be issued (hardcopy and electronic).

## 4.15 Reconciliation with Data Quality Objectives (D3)

Information obtained from the VBI70 Phase III Field Investigation will be evaluated through the Data Quality Assessment (DQA) process to determine if the data obtained are of the correct quality and quantity to support their intended use. The DQA process consists of five steps as summarized below (USEPA 1996).

# 5.0 DATA MANAGEMENT PLAN

This Data Management Plan (DMP) describes the data management practices to be implemented during the performance of the VBI70 Site Phase III Sampling Program. This DMP defines data flow paths, identifies and assigns organizational and individual responsibilities, and describes the procedures and protocols by which the data management processes function.

## 5.1 DMP Objectives

This DMP is designed to ensure that VBI70 Site data are collected in a consistent manner and transferred to a central repository in an orderly and timely manner. This DMP provides the structure required to incorporate and disseminate data collected during the Phase III Field Investigation.

In summary, the objectives of the DMP are to:

- Identify and assign organizational and individual responsibilities;
- Describe the flow of information through the data management process;
- Describe the checks and controls necessary to insure data accuracy and validity;
- Identify and address key data elements and process dependencies; and
- Provide an organized and controlled system for the handling of data that will allow future users to make informed decisions regarding the comparability of historical data sets.

## 5.2 Organizational Relationships

Key project personnel and organizational relationships are described in Section 1.0.

## 5.3 Organizational Responsibilities for the Database

The Project Data Manager (ISSI) is ultimately responsible for the overall data management process of the project database. This process includes the development, implementation, and maintenance of procedures and protocols to ensure that the data are properly documented, stored, retrieved, analyzed, and archived.

MK is responsible for maintaining project files of all data generated during the Phase III field investigation until these files are transferred to the final repository (the Project Database) at ISSI. MK and subcontracted analytical laboratories are responsible for collecting data according to project requirements; reviewing data for accuracy, completeness, and technical adequacy under approved quality control procedures; completing, reviewing, and signing appropriate data processing forms; and transferring original data and data forms to the RPM for cataloging and storage. It is the responsibility of the MK Site Manager to forward copies of all field and laboratory generated data to the RPM in a timely manner. Validated electronic updates of the database must be submitted by MK on a biweekly basis.

## 5.4 Data Management Team Responsibilities

The key personnel and primary responsibilities of the Data Management Team (DMT) are summarized below. It should be noted that some of the functional responsibilities described can be held by a single person or delegated to other individuals as appropriate. However, it is the responsibility of the person identified to ensure that tasks are completed.

Data Services Manager (ISSI) - Develops and revises standard operating procedures and protocols for the DMT to achieve data management guidelines. These procedures and protocols are subject to the approval of the USEPA Technical Contact for Data Management/GIS. The Data Services Manager or designate reviews all electronic and/or hardcopy deliverables submitted to the USEPA contact by the DMT and approves data management guidance documents and memoranda.

Project Database Manager (ISSI) – The Project Database Manager is responsible for overseeing the development, implementation, and maintenance of the computerized database used to electronically store and process project data. The Database Manager is also responsible for the identification and acquisition of hardware and software necessary for the efficient, effective storage, retrieval, and manipulation of computer-based data files. The Database Manager works with project management and technical personnel during initial project planning to identify those key data parameters to be included in the computerized project database and estimates the scope of required data programming, entry, database error-checking, and electronic file maintenance services. The Project Database Manager is also responsible for database security.

Field Activities Database Manager (MK) – The Field Activities Database Manager is responsible for overseeing the accurate and complete population and maintenance of the computerized database used to electronically store and process data obtained during field collection activities. The Field Activities Database Manager is responsible verification of electronic data entry and maintenance or hard copy forms and logbooks. The Field Activities Database Manager is also responsible for electronic database and document security.

Project Records Manager (ISSI) - The Project Records Manager is responsible for coordinating the receipt, cataloging and filing of all hard copy documents and electronic data deliverables. Upon receipt of a document, the Project Records Manager assigns it an ISSI Document Control Number (DCN) and enters this number in the Document Control Database. Electronic data are routed to the Database Manager for electronic data entry and processing. Hard copy data documents are stored in appropriate project files.

Field Activities Records Manager (MK) - The Field Activities Records Manager is responsible for coordinating the receipt, cataloging and filing of all hard copy documents and electronic data deliverables. Upon receipt of a document, the Field Activities Records Manager assigns it a MK Document Control Number (DCN). The Field Activities Records Manager reviews the document for legibility and completeness. Illegible or incomplete documents are returned to their source for correction/amendment and re-submittal. Hard copy data are forwarded to the Data Entry Clerk for manual data entry and independent data entry verification. Additionally, the Field Activities Records Manager is responsible for coordinating analytical laboratory services, communicating data deliverable requirements, receiving and routing completed laboratory data packages to qualified chemical data validation/verification personnel and ultimately submitting the validated/verified data to the Field Activities Database Manager for incorporation into the database.

Systems Programmer/Analyst (ISSI) - Systems Programmers/Analysts are responsible for assisting the Project Database Manager with developing, implementing, and maintaining computerized databases used to store project data.

Project Data Entry Clerk (ISSI) - Project Data Entry Clerks are responsible for the manual entry of selected project data into the electronic database under the direct supervision of the Project Database Manager. Project Data Entry Clerks also perform independent error-checks on the data files and make corrections as needed.

Field Activities Data Entry Clerk (MK) - Field Activities Data Entry Clerks are responsible for the manual entry of selected project data into the electronic database under the direct supervision of the Field Activities Database Manager. Field Activities Data Entry Clerks also perform independent error-checks on the data files and make corrections as needed.

## 5.5 Forms of Data

A variety of data forms are anticipated to be collected during the Phase III Field Activities. These include, but not limited to:

- Field forms
- Field observations and measurements
- Maps
- Photographs
- Laboratory analysis results and quality control data

Field Forms - These data include identification of sampling locations, the spatial layout and design of existing buildings and structures. The procedures by which these forms are completed are summarized in the FSP (Section 3.0).

Field Observations - These data include descriptions of unusual conditions or weather encountered during sampling. The procedures by which these observation are made are summarized in the FSP (Section 3.0).

Maps - Maps may be developed in the field in coordination of sampling efforts (field diagrams) or may be prepared after sampling is complete using GIS tools.

Photographs - Photographs may be taken during implementation of field activities when visual records of the activities are required. Additionally, aerial photographs of the site may be used as a GIS tool for development of a base map of the site.

Laboratory Analyses - The results of physical and chemical laboratory analyses of field samples are another form of data that will be incorporated into the database. Typically, these data are acquired from laboratories in hard copy and/or electronic format.

Differing levels of reliability may be placed on data with respect to their accuracy and precision. Within the context of data management, two distinct types of data will be stored in the Project Database: primary and secondary.

### 5.5.1 Primary Data

Primary data derive principally from two sources: on-site field observations and laboratory analyses of physical samples taken as a part of on-site investigations. Because these data are collected and testing using procedures and protocols outlined in the Project Plan, they are of quantifiable accuracy and precision. Examples of primary data include field forms, field observations, field maps (diagrams) and analytical laboratory data.

### 5.5.2 Secondary Data

Secondary data include all data generated by private and public entities outside of the scope of the Project Plan. These data typically include such documents as:

- Site-specific and regional vicinity maps
- Historical land use and property ownership records
- Regional geologic, and hydrologic survey data collected by outside firms and public agencies
- Site-specific physical and chemical data generated by outside firms and agencies
- Published accounts of investigations undertaken at other sites that may assist in the analysis and interpretation of site-specific primary data collected

If not carefully documented, secondary data can be of variable and indeterminate accuracy and precision. Whenever data obtained from secondary sources are of uncertain merit, they must be used with caution in any decision-making process.

## 5.6 Data Flow

A conceptual diagram of data flow for the Phase III sampling is presented in Figure 3-1 of the FSP (Section 3.0). The following sections describe the sources of information and the processes identified for the collection, transfer and organization of primary and secondary data sources.

### 5.6.1 Reference Data Sources

Two principle sources of secondary data are utilized in the collection and management of information for the Phase III investigation, the 1998 City and County of Denver Tax Assessment data and the historical VBI70 Phase I and Phase II site investigation data. These data are used for the purpose of generating key derivative reference tables (Access Agreement DB). As stated in the FSP (Section 3.2), the Access Agreement DB are updated as new data are received during implementation of the Phase III investigation.

1998 City and County of Denver Tax Assessor Data - The initial source of data for property and ownership information is the 1998 City and County of Denver Tax Assessor data purchased from Property Data Center, Inc. (PDC). These data consist of approximately 11,000 property and ownership records bounded to the North by East 52nd Avenue, to the South by East 26th Avenue, to the East by Colorado Boulevard, and to the West by Inca Street. Some of the data points included are: property addresses, coordinates, land use classifications, living area square footage, and ownership information.

Historical Phase I and Phase II Sampling Data – Roughly 1500 properties were sampled for metals in 1998 by Superfund Technical Assessment and Response Team (START) and Response Engineering and Analytical Contract (REAC) personnel. This information is used initially to simply exclude previously sampled properties from the Phase III field sampling event.

The reference tables and data points derived from the reference data are summarized below.

| Reference Table | Data Points |
|---|---|
| List of Prospective Properties | Property address<br>Geographic coordinates<br>Land use classifications<br>Total living area |
| Ownership Information | Owner name<br>Owner address |
| Access Agreements | Date of mailing<br>Authorization status<br>Contact information and language preference |

The list of all prospective properties is processed, using study area boundary and historical sampling information, to form a list of target properties. Agreement letters requesting authorization for access are then generated for owners of target properties and tracked as described in Section 3.0.

### 5.6.2 Data Acquisition

This section summarizes the collection, transfer and organization of primary field observations and laboratory analyses with regard to the data management process. Details regarding specific data collection procedures can be found in the FSP (Section 3.2.2).

#### 5.6.2.1 Field Sampling

Prior to field sampling, a list of properties approved for sampling is generated by the Site Manager. Each sampling team is then given blank copies of media specific data collection forms and a set of pre-printed sample identification numbers printed on self-adhesive labels. Two labels are generated for each sample number. When a sample of site medium is collected (e.g., yard soil, indoor dust, alleyway soil), one copy of the sample number is placed on the sample container and the other copy placed on the corresponding field data collection form. The data form is filled out at the time of sample collection by the sample collection team according to procedures detailed in the FSP (Section 3.0).

Upon completion of daily sampling activities, the sampling team returns to the field office location with samples and corresponding data sheets. The Sample Custodian maintains a log of sample identification numbers that have been used, noting any missing or destroyed labels. Data sheets are forwarded to the FPL for review. Verified forms are then forwarded for entry into the Field Activities Database.

#### 5.6.2.2 Sample Shipping

Subsequent to the entry of the data collection forms, the Sample Custodian generates a multi-part chain-of-custody form from the Field Activities Database. The chain-of-custody lists the following information:

- Sample ID
- Sample Medium
- Date Collected
- Analytes and method references requested for analysis
- Inventory verification check for inclusion of the physical sample for shipment
- Additional notes
- Custody Signatures of relinquisher and receiver
- Dates of relinquishment and receipt

The COC form accompanies the samples for shipment to the laboratory as described in the FSP (Section 3.0).

#### 5.6.2.3 Laboratory Data Entry

During sample analysis at the laboratory, analytical results are either entered into the laboratory information management system or directly downloaded from the analytical instrument. The data is reviewed in the laboratory for errors or omissions to assure that the data are reported in the correct format. Upon completion of these efforts, the laboratory submits the data electronically accompanied by the hardcopy raw data to the Field Activities Records Manager. All data transfer activities follow only after appropriate data screening, verification and validation procedures.

## 5.7 <u>Database Organization</u>

A database consists of conceptual and physical design components. The conceptual design integrates the intended function, contents, and products of the project database; the procedures for data entry and electronic data incorporation; the needs of data users; and compatibility requirements (within database software limitations). The physical design implements the conceptual design through programming, data incorporation, and built-in software functions.

In addition to meeting the needs of data users, the database management system will incorporate the following capabilities:

- Store tabular data (such as analytical results, qualifier codes, sample locations) in a relational database management system.
- Allow the user to query multidisciplinary data.
- Provide an audit trail for sample tracking, including a QA program to minimize erroneous data entry.
- Allow integration of new data.
- Document the database structure, code definitions, and means of accessing information.

Electronic data in tabulated format will be stored and retrieved through a Microsoft Access® database. The main components of Access® databases are tables, relationships between tables, and queries. Tables store the data in a structure consisting of rows and columns. Relationships define how data in one table relate to data in another table. Queries store the framework for selecting subsets of data from tables. The database is constructed of data tables and reference, or "look-up" tables. A detailed description of the Project Database structure is presented in Appendix F.

The following outlines present a generalized structure of the data tables and field attributes for the project database.

*For Properties Approved for Sampling*:

Property Location Information
- House Number
- Street Name
- Neighborhood

Property Surface Soil Sample Information
- Building Type (Residential, School, Park, Alleyway)
- Depth of Sample
- Sample Type (Composite, Grab)

Property Indoor Dust Sample Information
- Number of Templates Collected
- Number of Templates Taken

<u>All Media</u>

- Chain-of-Custody Information
- Analytical Results
- Analysis and Sample Preparation Methods
- Laboratory and Validation Qualifiers

<u>Access Agreement Tables</u>

*Owner Information Table*

- Owner Contact Information
- Owner Language Preference

*Access Agreement Letter Table*

- Target Property Address
- Date Letter was Sent
- Status of Access Authorization (approved or denied)

## 5.8 Data Screening, Verification, and Validation

All documents received and catalogued by the DMT are subject to review. Two separate and distinct levels of document review are performed:

- Data Verification
- Data Validation

The following paragraphs describe the performance of these two levels of data review.

### 5.8.1 Data Verification

The term verification refers to a review process in which data are checked for accuracy and completeness. The Project Database Manager and Field Activities Database Manager are responsible for overseeing this effort. Data verification will be performed on all original data (e.g., sample data collection sheets) to ensure that all information is correct. Any hardcopy or electronic data requiring modification as a result of the verification effort are returned to the source for amendment or correction. After the correction or amendment is complete, the data are then returned to the Project Database Manager or Field Activities Database Manager (as appropriate) and are re-verified to ensure that the appropriate corrections and/or amendments were performed correctly.

### 5.8.2 Data Validation

Data validation, as it pertains to database management, refers to a point-by-point comparison of the database with the primary data source (e.g., data collection sheets, COC forms, etc.). Database validation will be performed on all data transfers, however, the extent of that validation effort is dependent on how the data were compiled into the database.

Manual Data Entry

One hundred percent of all data entered onto a database table will be verified for accuracy. If corrections or amendments are required as a result of the review, this will be performed in accord with the details outlined in Section 5.9. After the correction of amendment is complete, the data are returned and are points where corrections were requested are re-validated to ensure that the appropriate corrections and/or amendments were performed correctly.

Electronic Data Transfer

Ten percent of all data that are transferred in electronic form will be verified for accuracy against the original hardcopy data. If corrections or amendments are required as a result of the review, this will be performed in accord with the details outlined in Section 5.8.3. After the correction of amendment is complete, the data are returned and are points where corrections were requested are re-validated to ensure that the appropriate corrections and/or amendments were performed correctly.

Because errors in the data were observed, further verification of the electronic data is now necessary. One hundred percent of the data that are transferred in electronic form will now be required. If corrections or amendments are required as a result of the review, this will be performed in accord with the details outlined in Section 5.9. After the correction of amendment is complete, the data are returned and are points where corrections were requested are re-validated to ensure that the appropriate corrections and/or amendments were performed correctly.

### 5.8.3 Data Amendment/Correction

Because errors may be identified at any time during the data management process, however, provisions for making formal corrections or amendments to the Project Database are made for uniformly addressing and tracking all data amendments/corrections. The process, described below, refers only to data that has been formally transferred to the DMT.

The Data Amendment/Correction form (Figure 5-1) provides the mechanism to request changes to a document or electronic data record and provides an audit trail of subsequent data processing.

Changes to data requested as a result of data screening are routed to the Project Records Manager along with a Data Amendment/Correction form and a copy of the document requiring revision. The Project Records Manager assigns a request number to the form and logs it into the Document Control Database before forwarding the change order to the appropriate party.

## Figure 5-1 – Data Amendment/Correction Form

| ISSI Consulting Group, Inc.<br>999 18th Street, Suite 1450<br>Denver, CO 80202<br>Phone: (303) 292-4142<br>Fax: (303) 292-4926 | Data Amendment/<br>Correction | DCN: ______<br>File #: ______ |
|---|---|---|
| Project Number: | Project Name: | Request Number: |
| Document Number: | Document Title/Description: | Due Date: |

Description of Amendments/Corrections (Attach supporting documentation showing changes)

| | | | |
|---|---|---|---|
| Requested By: | Print Name | Initials | Date |
| Approved By: | Site Manager | Initials | Date |
| Processed By: | Data Management Team | Initials | Date |

## 5.9 Records Management

Data storage and security are critical aspects of data management. During the life of a project, all data developed as a consequence of field, laboratory, archival, and analytic investigations are under the direct control of the DMT. In the paragraphs that follow, descriptions are provided of the controls that the DMT uses for the storage, access, maintenance and security of project technical documents.

### 5.9.1 Document Control

All data documents generated during the Phase III Field Investigation will routed to the the DMT for cataloging and storage. A document may consist of a report, a single piece of paper, a map, a computer disk or a set of hardcopy records. A copy of all documentation is made. The copy is retained in the Project File and all original documentation is forwarded to the USEPA RPM.

Upon receipt of a technical data document, the Project Records Manager assigns it a Project DCN. This number is used to uniquely identify each document during all subsequent processing and filing. The DCN is a five-digit identifier that is used to serially number all documents. Each document received by the Project Records Manager is stamped and the following transmittal information is completed:

Received By: ___________
Received From: __________
Received Date: __________
DCN Assigned: __________

### 5.9.2 Short-Term Records Management

Short-term records management is defined as the controlled storage of data in either hardcopy or electronic formats during the active life of a project. Records management also includes the procedures and protocols that are used to control access to as well as physical security of project technical data. The following paragraphs describe the storage and security requirements for both hard copy and electronically formatted data files.

#### 5.9.2.1 Hardcopy Data Files

Two separate categories of hardcopy files are identified for the management of project documents: Master Files and Project Files.

Master Files - The master files are the repository for original and amended copies of all project primary data, which include field forms, notebooks, maps, and laboratory data packages. These files also include any secondary and interpretive data that are considered important to the project decision-making process. These master files are stored in secure locations, and access to them is restricted to the USEPA Project Manager and select members of the project team. These files as well as other administrative records are eventually transferred to, or are currently under the formal custody of the USEPA Records Center. These files are stamped "original" in blue or red ink.

Project Files - The project files are in-house duplicate copies of the master files. In addition, they may contain copies of secondary and interpretive data documents. The project files are stored in locked file cabinets. Access to these files is restricted to the Project Records Manager and select project personnel. These files are stamped "copy".

In addition to routinely distributed working files, the DMT also makes working data available to project personnel on an as requested basis. The mechanism for doing so is the Request for Data Services Form (Figure 5-2) on which the requestor identifies the particular document or set of documents desired and the date/time needed.

# Figure 5-2 Request for Data Services Form

ISSI Consulting Group, Inc.
999 18th Street, Suite 1450
Denver, CO 80202
Phone: (303) 292-4142
Fax: (303) 292-4926

## Request for Data Services

DCN: ____________

| Project Number: | Project Name: | Request Date: | Due Date: |
|---|---|---|---|
| | | | |

| Requested By: | Deliver To: |
|---|---|
| Name/Company: ____________ | Name/Company: ____________ |
| Address: ____________ | Address: ____________ |
| City/State/Zip: ____________ | City/State/Zip: ____________ |
| Phone: ____________ | Phone: ____________ |
| Fax: ____________ | Fax: ____________ |
| E-mail: ____________ | E-mail: ____________ |

Data Request Type: ☐ Entry ☐ Verification ☐ Analysis ☐ Reporting ☐ Other ____________

Data Format: ☐ Hard Copy ☐ Electronic Format: ____________

Request Description: (Attach supporting documentation if necessary)

____________

**Data Management Team Use Only**

Estimated Time to Complete: ______ Hours

Resource Requirements: ____________

Comments: ____________

| | | | |
|---|---|---|---|
| Received By: | Print Name | Initials | Date |
| Processed By: | Print Name | Initials | Date |
| Reviewed By: | Print Name | Initials | Date |

#### 5.9.2.2 Electronic Data Files

In addition to hard-copy versions of project technical data, the DMT is responsible for the electronic storage and maintenance of field and laboratory data. Because of the importance of these files to the overall decision-making process, considerable care is exercised by the DMT in the creation, maintenance, and security of the project's computerized database. The paragraphs that follow describe the procedures and protocols for electronic data entry, verification, maintenance and access/security.

Data Entry - Data entry includes both manual transfer of information from hard copy records and automated transfer from electronic files. Typically, manual data entry is used for field data and electronic transfer is used for laboratory data. Most data parameters are identified during project planning and therefore are systematically entered into the project database. Data later identified for electronic management may be accommodated by filing a Request for Data Services form with the Data Management Team specifying the nature and scope of data entry efforts (see Figure 5-2).

Data Verification - Typically, data entry makes use of only screened, verified, and validated records and, once data are entered, they are verified against those records for accuracy and completeness. The method used to verify the electronic record varies according to the means by which data are entered. For manual input, a double-key entry protocol typically is used for simultaneous data verification. When double-key entry is not possible, a 100% manual verification of data is independently performed against hard copy reports. For electronic uploads, a 20% portion of the electronic data is compared against hard copy reports. Any errors identified during the verification process are corrected before committing the data to the project database and furthe

Database Maintenance - To ensure the integrity of the project database, the Systems Programmer/Analyst performs regular, periodic file maintenance activities. These include making daily backup copies of all database files to provide the means to restore them in the event of system failure or file corruption. Modifications to database structures are only performed at the direction or approval of the various investigators and data users. Changes to database structures are accommodated and documented by filing a Request for Data Services form with the Data Management Team.

Database Access and Security - In order to minimize the potential for data corruption, access to the project database is password-protected. For example, as system administrator, only the Project Database Manager (or designee) is allowed to alter the structure of the database or its underlying programming. Project managers and technical personnel have read-only access to the database. They may perform on-line query or analyses of the data without restriction; however, they cannot alter the structure or content of the database. They may also request that the DMT provide hard copy summary reports or diskette copies of particular data sets. These requests are filed with the DMT using the Request for Data Services form. Files downloaded to project personnel are treated as derivative primary data and are not recorded in the Document Control Database. They also are not incorporated into the Master Document Files or the Project Files because they can be re-created from the project database.

### 5.9.3 Long Term Records Management

Data and records of data generated as a result of USEPA work assignments are the property of the USEPA. Long-term management of data files is outside of the responsibility of the Data Management Team. Upon completion of the work assignment, Master Document Files as well as electronic copies of the Project Database and Document Control Database will be transferred to the custody of the USEPA Records Center.

## 6.0 REFERENCES

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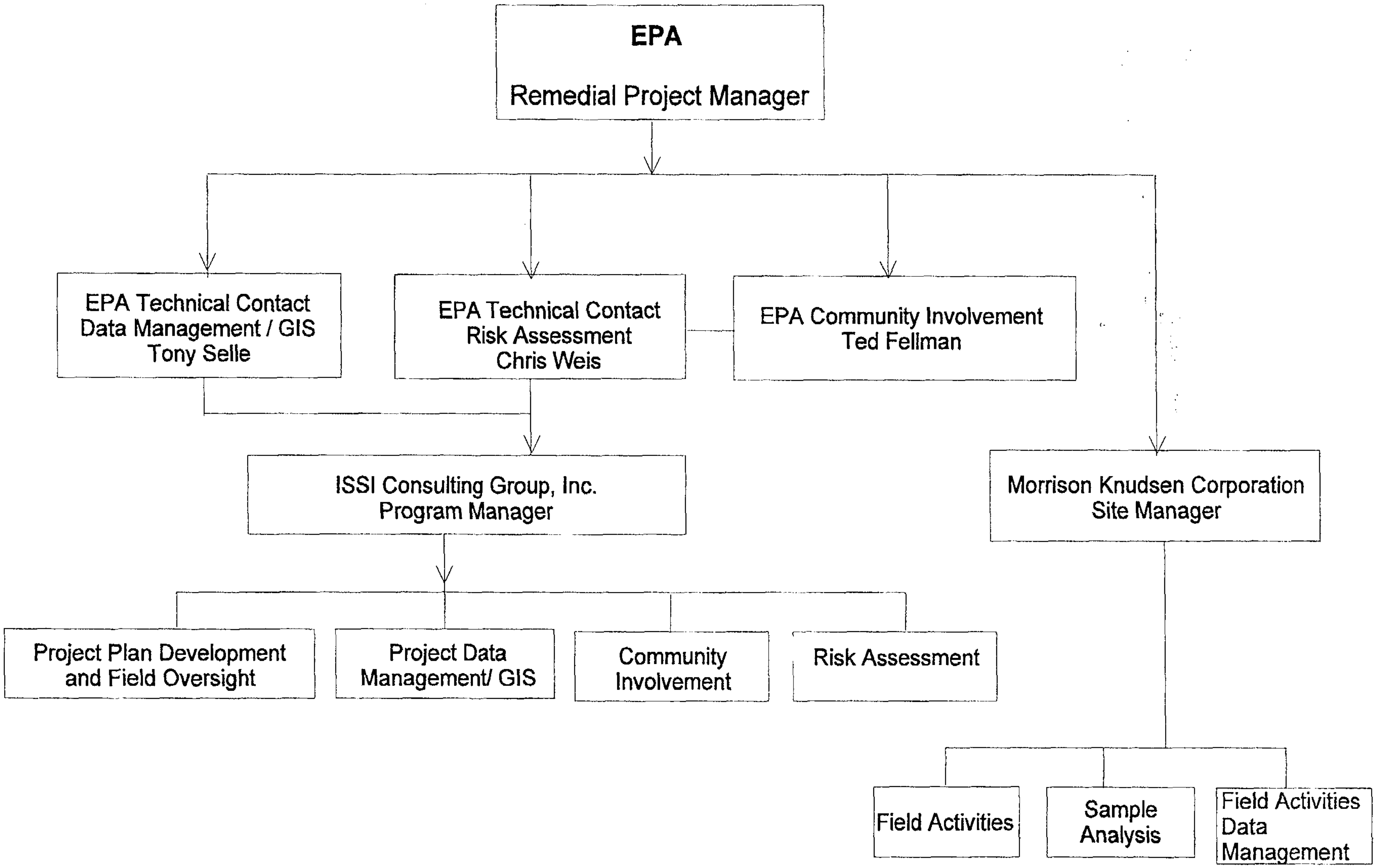
# Figures and Tables

**Figure 1-1: Organizational Chart for the Phase III Activities at the VBI70 Site**



EPA REGION VIII
SUPERFUND DOCUMENT MANAGEMENT SYSTEM

DOC ID # 211495
PAGE #

IMAGERY COVER SHEET
UNSCANNABLE ITEM

Contact the Superfund Records Center to view this document.

SITE NAME Vasquez Boulevard & I-70 Site

OPERABLE UNIT

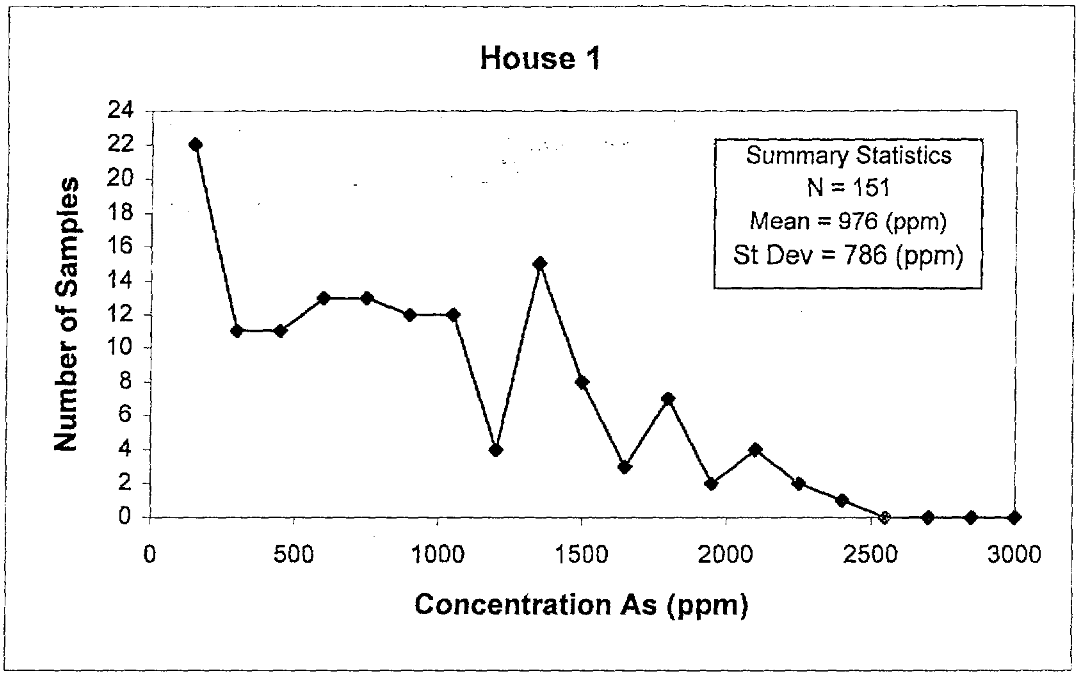
REPORT OR DOCUMENT TITLE Draft Project Plan for Vasquez Blvd & I 70 Site

DATE OF DOCUMENT June 30, 1999

DESCRIPTION OF IMAGERY ~~Arial~~ Photo
Site Boundary for Phase III

NUMBER AND TYPE OF IMAGERY ITEM(S) 1

## Figure 2-1: Distribution of Arsenic Values at Impacted Properties



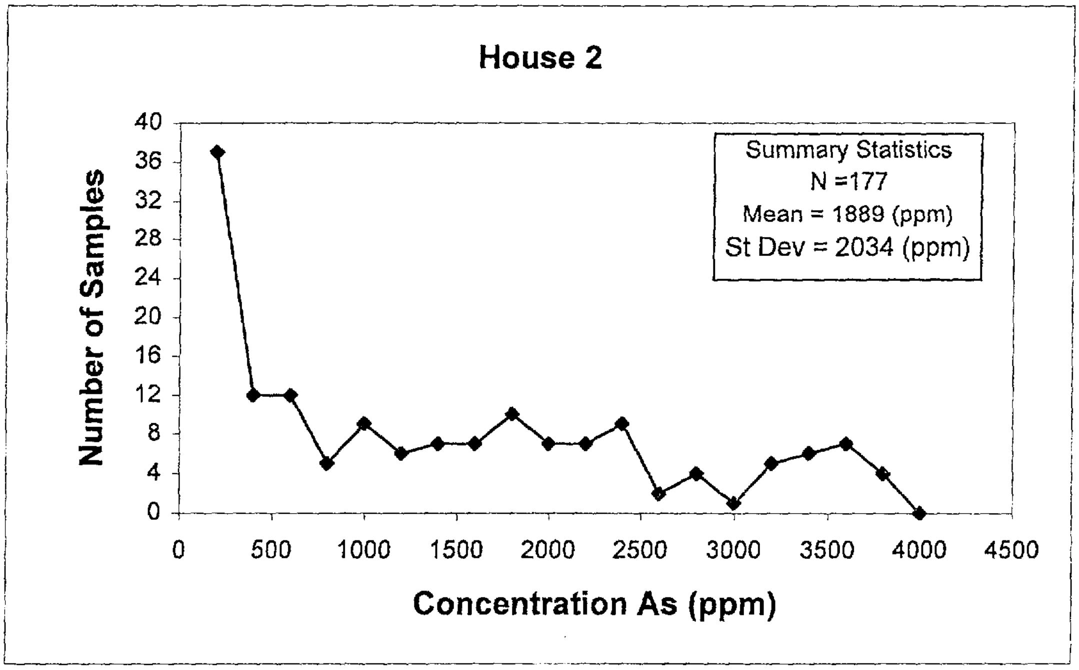
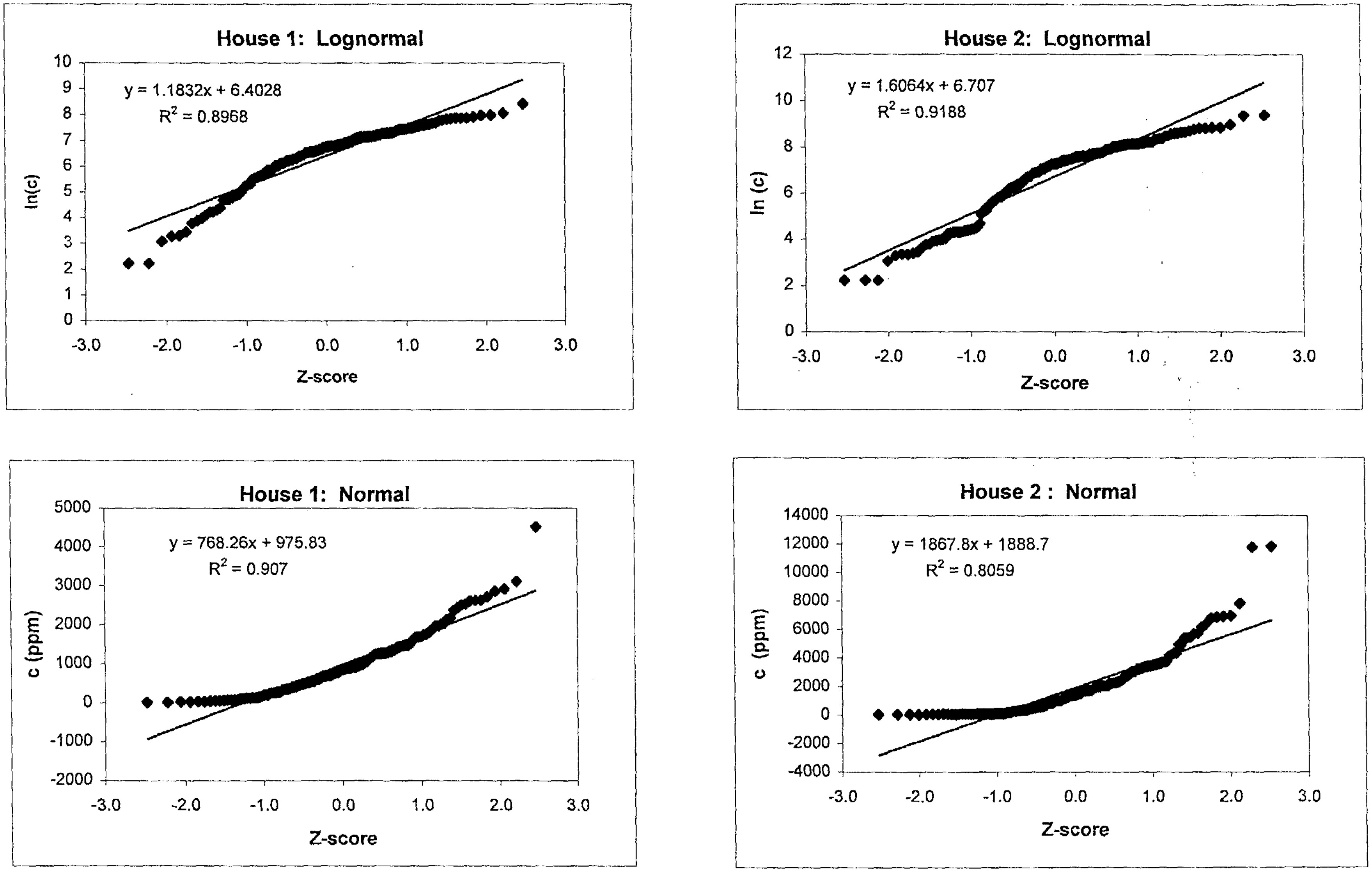
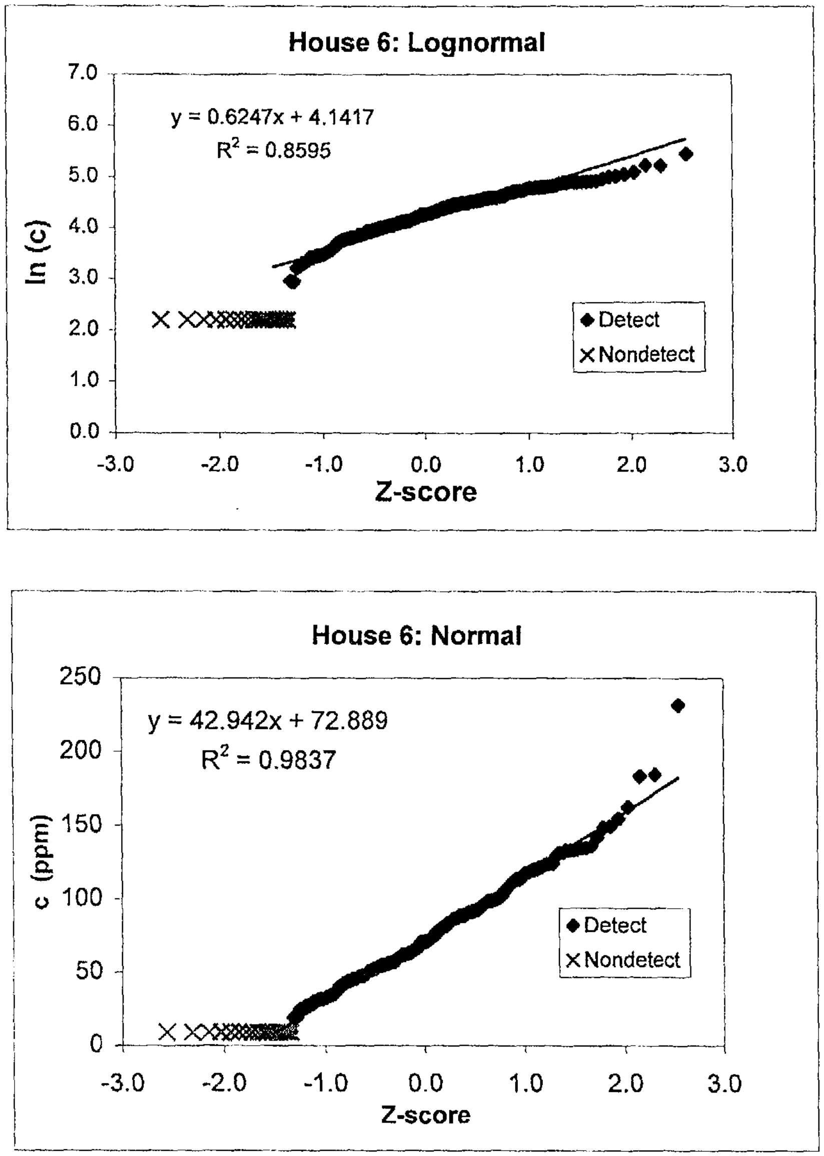



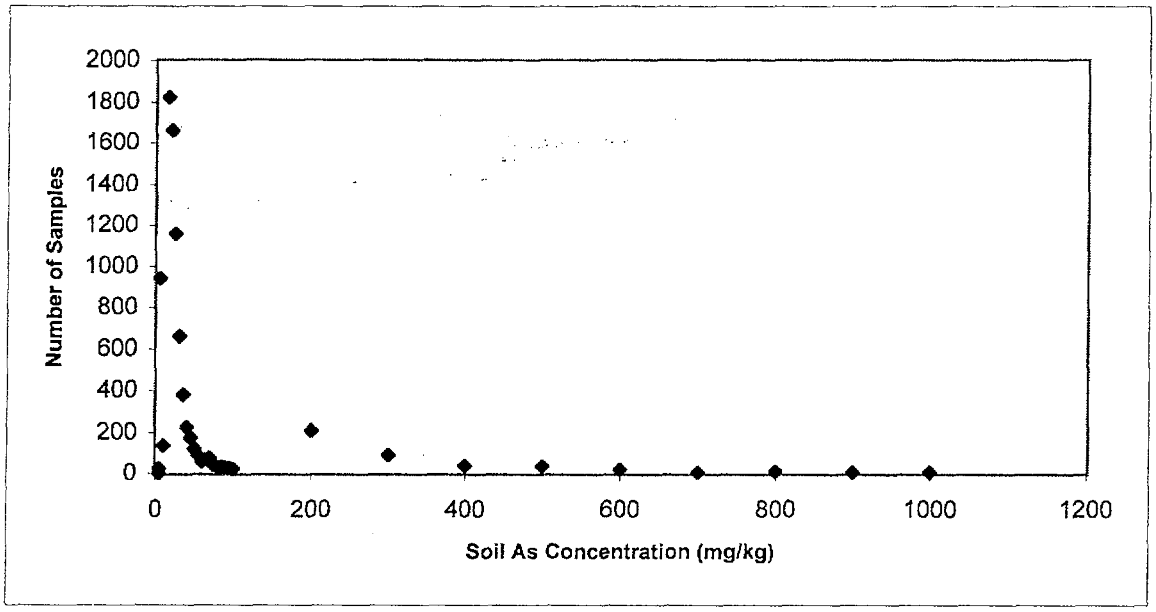
**Figure 2-2: Probability Plots of Arsenic Distribution at Impacted Properties**

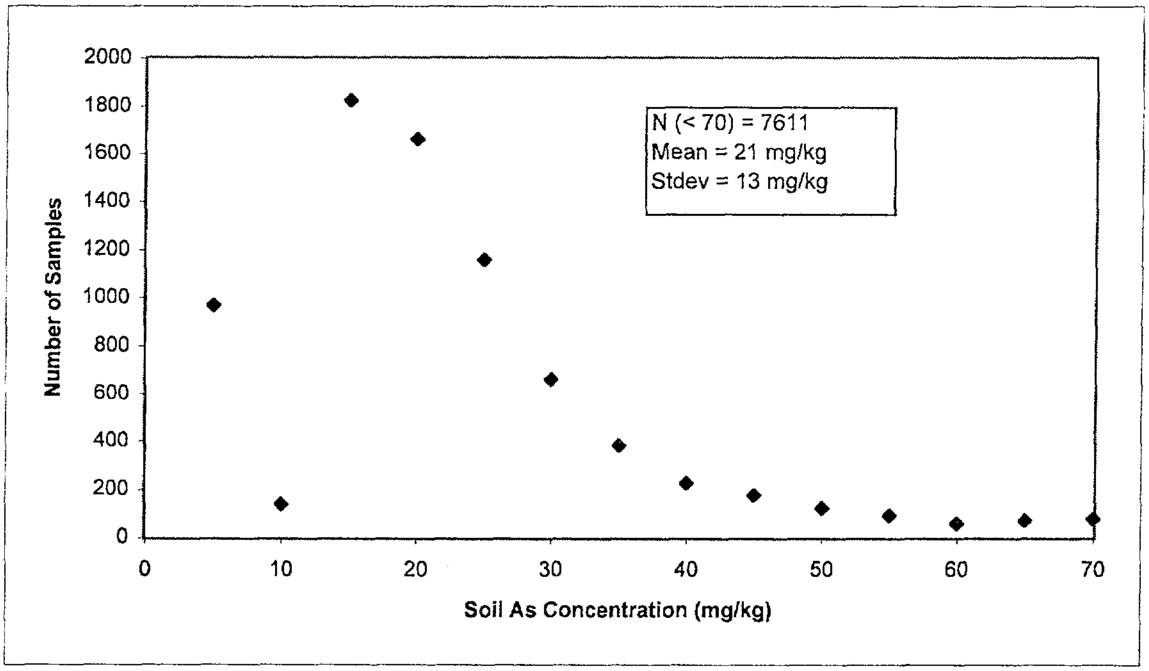


## Figure 2-3: Probability Plots of Arsenic Distribution for Minimally Impacted Properties



## Figure 2-4. Arsenic Levels in Surface Soil at Unimpacted Residences in the Globeville Area

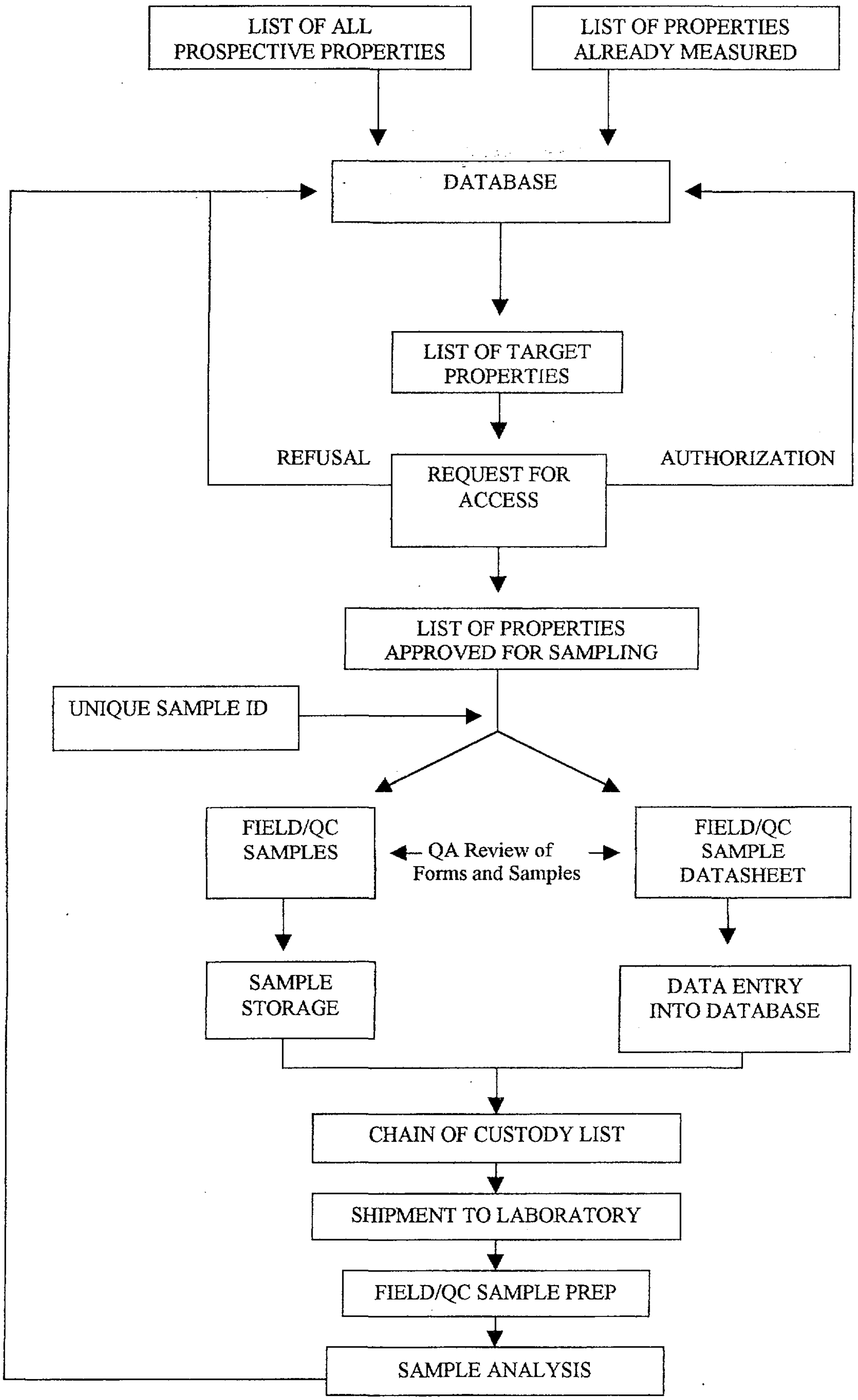



Note: All samples below the detection limit (10 ppm) were assigned a value of 5 mg/kg

Data Source: ASARCO (1999)

Figure 3-1 Phase III Sample Flow Chart



## Figure 3-2 Proposed Grid Sampling Design for Residential Surface Soil

**Step 1:**

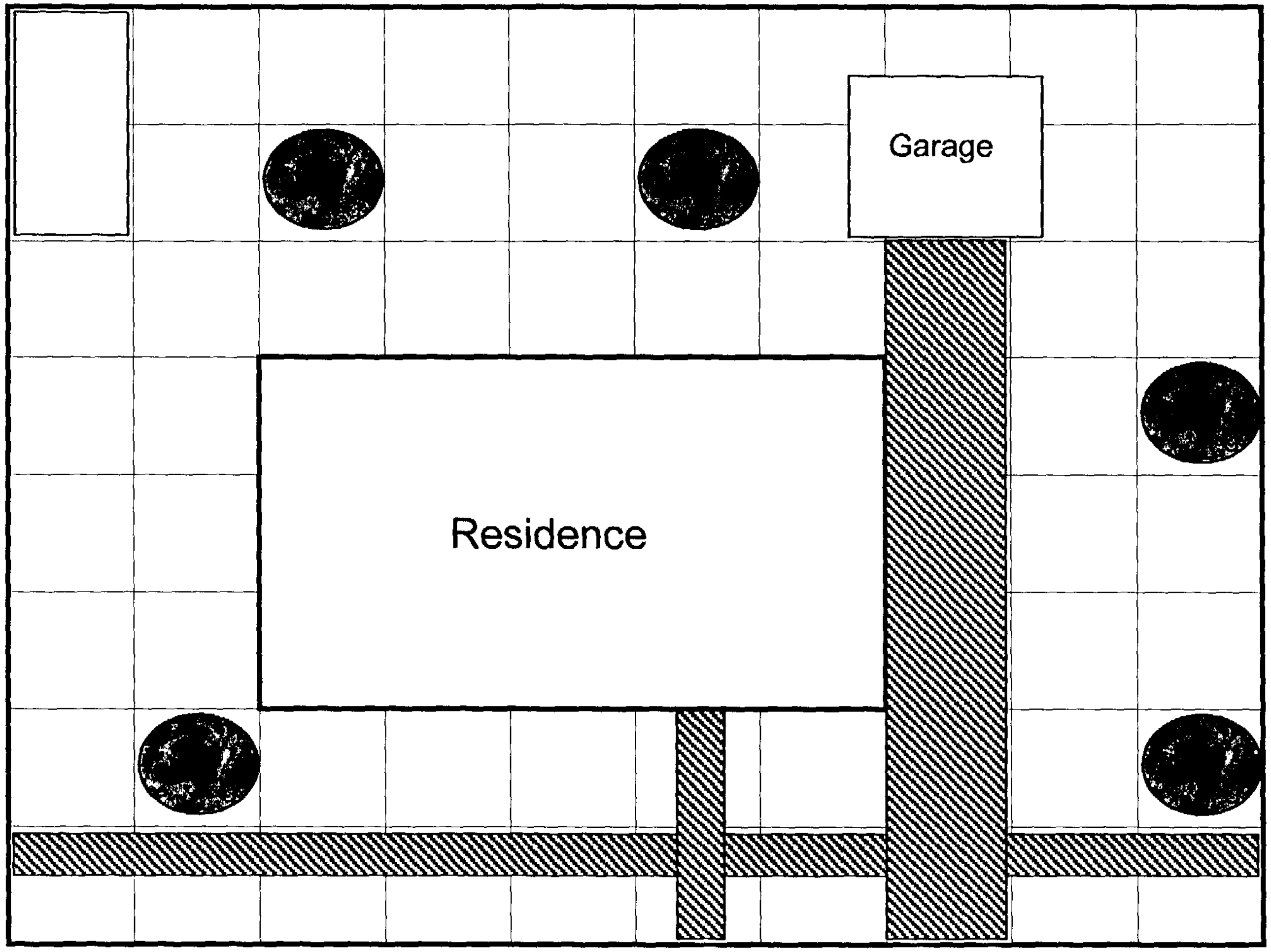
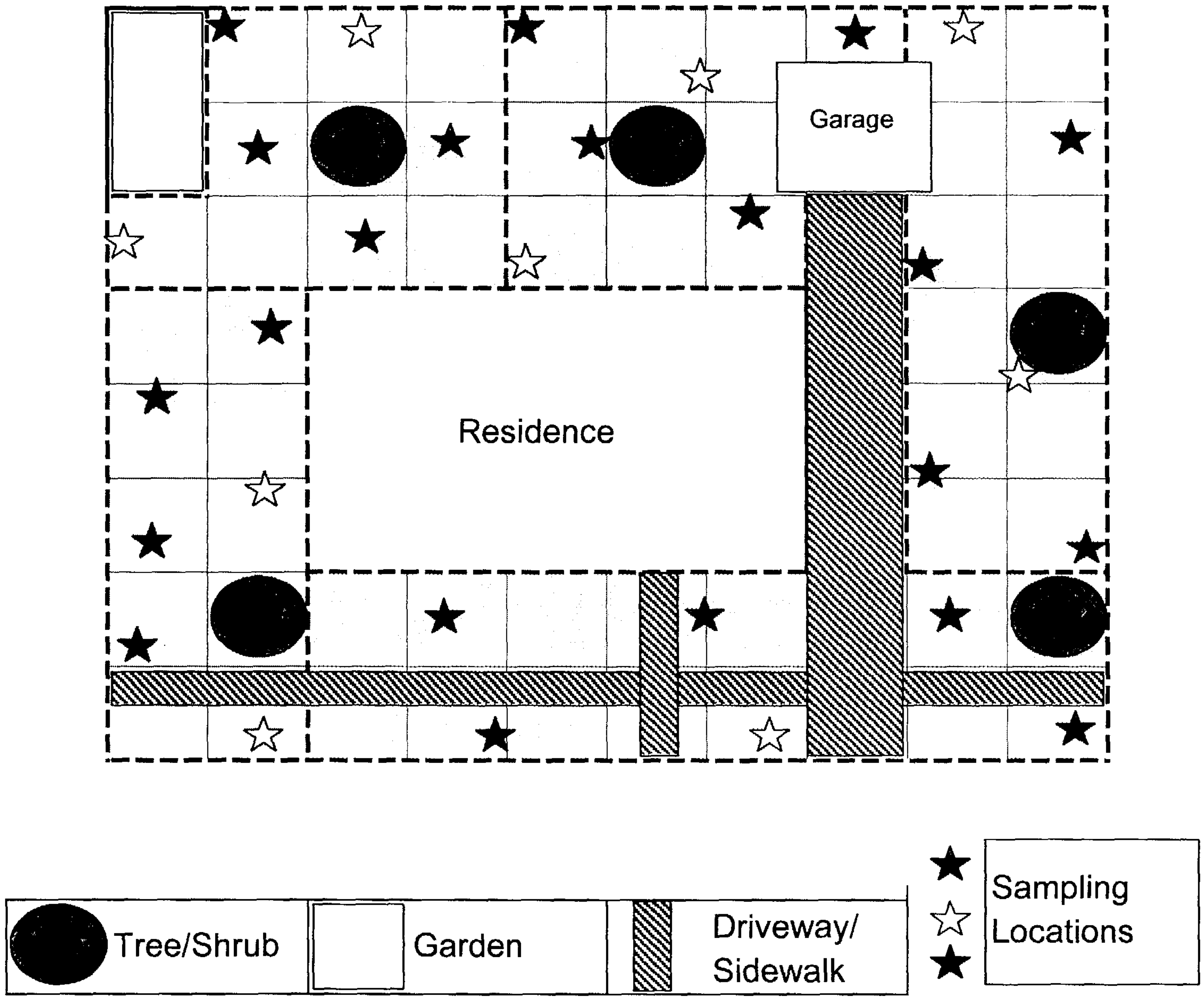



Figure 3-2YARDGRID.xls

## Figure 3-3 Proposed Grid Sampling Design for Residential Surface Soil

**Step 2:**



Logbook DCN______

# Figure 3-4

## SURFACE SOIL
## DATA SHEET

ISSI

**PHASE:** 3

**MEDIUM:** SURFACE SOIL

**SOP:** ISSI-VBI70-02 Revision 0

**DEPTH:** 0-2"

**DATE:** ______

**SAMPLE TEAM ID:** ______

**LOCATION:** ______ ______

*House#* *Street Name*

**BUILDING TYPE:** Residential -- Single
Multifamily
Apartment

School -- ______
*Name*

Park -- ______
*Name*

**CLASS:** FS

**SAMPLE TYPE:** COMP
GRAB

**SAMPLE NO.:**

**Red** ______

**Blue** ______

**Yellow** ______

**GARDEN PRESENT?** Yes No

**ADDRESS CONFIRMED BY RESIDENT?** Yes No

**WILLING TO ALLOW FURTHER SAMPLING?** Yes No

**NOTES:**

Logbook DCN ______

**Field Diagram:**

N

**Samples Collected by:** ______________________ ______________
*Signature* *Date*

**Logbook Page Reviewed by:** ______________________ ______________
*Signature* *Date*

# Figure 3-5

Logbook DCN______

## VBI70 Field Sample Preparation Logbook Sheet

| Sample ID | Air Drying | | Sieving | | | Notes |
| --- | --- | --- | --- | --- | --- | --- |
| | | | Date Sieved | Particle Size Fraction[b] | | |
| | Date/Time[a] Drying Begun | Date/Time[a] Drying Completed | | Bulk (<2 mm) | Fine (<250 µm) | |
| | | | | | | |
| | | | | | | |
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[a]: Enter Date in the following format: mm/dd/yy; Enter Time as 24-hour time (eg. 1340)

[b] :Mark an "X" for each sieve fraction collected

# Figure 3-6

Logbook DCN______

## VBI70 QC Data Sheet
## Blind Soil Field Splits

| Date | Sample ID# | Sample Class | Original Sample ID | Prepared By | Notes |
|---|---|---|---|---|---|
| | | BD | | | |
| | | BD | | | |
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| | | BD | | | |

Logbook DCN______

**Figure 3-7**

## VBI70 QC Data Sheet
## Soil Performance Evaluation Standards

| Date | Sample # | Sample Class | Lot No. | Certified Concentration | | Prepared By |
|---|---|---|---|---|---|---|
| | | | | Arsenic (ppm) | Lead (ppm) | |
| | | PE | | | | |
| | | PE | | | | |
| | | PE | | | | |
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| | | PE | | | | |
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| | | PE | | | | |
| | | PE | | | | |

## VBI70 Indoor Dust Scheduling Sheet

DATE ______________________________

| Time | House Number | Street Name | Comments / Special Instructions | Property Access Authorization [1] | |
|---|---|---|---|---|---|
| | | | | Property Owner Authorization for Site Access? | Renter Authorization for Site Access? |
| 8:00 AM | | | | | |
| 8:30 AM | | | | | |
| 9:00 AM | | | | | |
| 9:30 AM | | | | | |
| 10:00 AM | | | | | |
| 10:30 AM | | | | | |
| 11:00 AM | | | | | |
| 11:30 AM | | | | | |
| 12:00 PM | | | | | |
| 12:30 PM | | | | | |
| 1:00 PM | | | | | |
| 1:30 PM | | | | | |
| 2:00 PM | | | | | |
| 2:30 PM | | | | | |
| 3:00 PM | | | | | |
| 3:30 PM | | | | | |
| 4:00 PM | | | | | |
| 4:30 PM | | | | | |
| 5:00 PM | | | | | |
| 5:30 PM | | | | | |
| 6:00 PM | | | | | |

**Notes:**

[1] Refer to the Master Access Agreement Log. Indicate with an "X" if available, "NA" if not applicable, or "NO" if access has not been authorized. Do not schedule for dust sampling if "NO" is indicated.

DCN ______

# FIGURE 3-9
# INDOOR DUST DATA SHEET

PHASE: 3

MEDIUM: INDOOR DUST

SOP: SI-VBI70-03 Revision 0

DATE: ____________

SAMPLE TEAM ID: ____________

LOCATION: ____________ ____________
*House#* *Street Name*

CLASS: FS (Field Sample)
EB (Equipment Blank)
FB (Field Blank)

SAMPLE TYPE: COMP

TEMPLATE SIZE: 4 $ft^2$

TEMPLATE COLLECTION LOCATIONS:

| Number | Living Area (a) | Surface Type (b) | Notes |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| 6 | | | |
| 7 | | | |
| 8 | | | |
| 9 | | | |
| 10 | | | |
| 11 | | | |
| 12 | | | |
| 13 | | | |
| 14 | | | |
| 15 | | | |
| 16 | | | |
| 17 | | | |
| 18 | | | |

**(a) Living Area Codes:**
BR = bedroom
FR = family room / living room
K = kitchen
D = dining / eating area
H = hall way
E = entry way
O = other (note which)______

**(b) Surface Types:**
H = hard (linoleum, stone, wood, etc.)
S = soft (carpet, rug, etc.)
O = other (note which)______

# Figure 3-9 (cont.)

**Field Diagram:** Logbook DCN ______

**Samples Collected by:** ______________________ ____________
*Signature* *Date*

**Logbook Page Reviewed by:** ______________________ ____________
*Signature* *Date*

## Figure 3-10 Typical Sampling Plan at an Alleyway

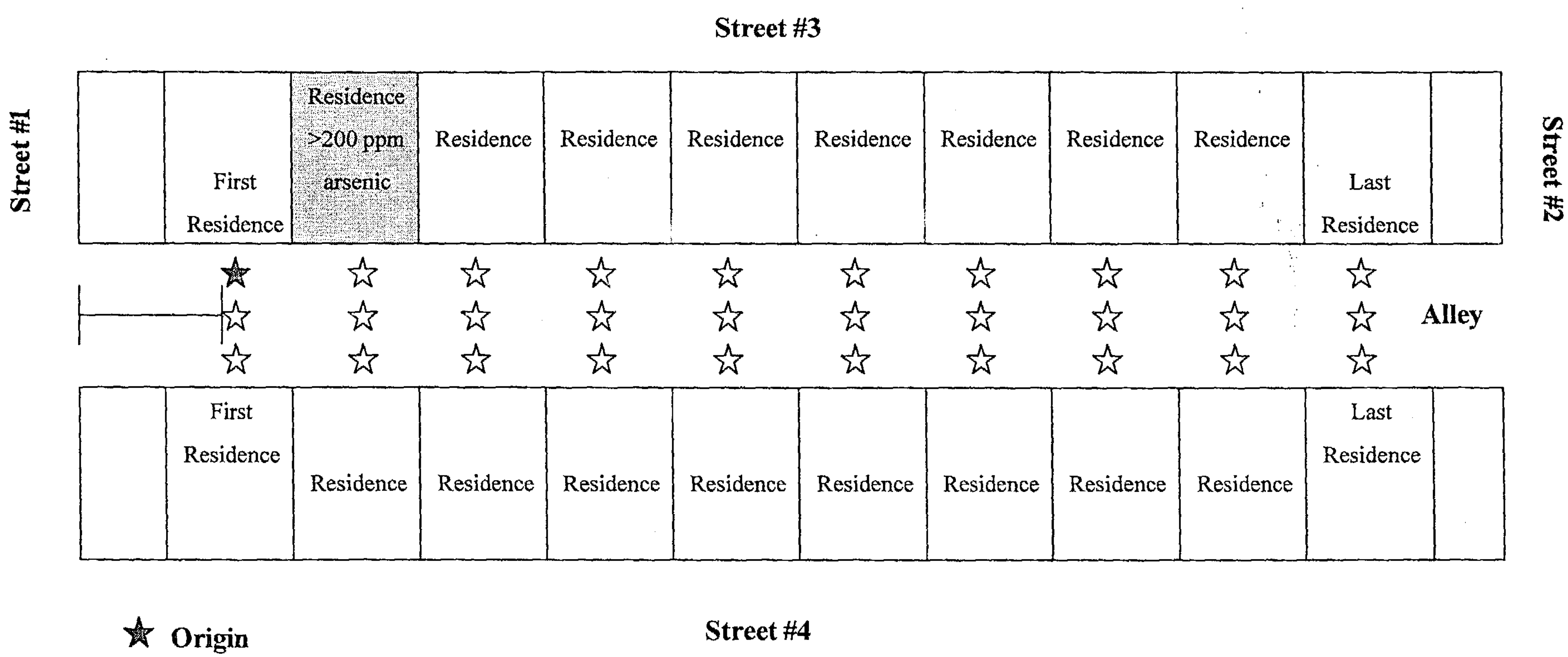

Figure 3-11

Logbook DCN_______

# VBI70 Alleyway
# SOIL DATA SHEET

PHASE: 3

MEDIUM: Alley Soil

DATE: ____________

DEPTH: 0-2"

LOCATION: ____________

SOP: ISSI-VBI70-02 Revision 0

SAMPLE TEAM ID: ____________

LENGTH OF ALLEY: ____________

INTER-SAMPLE DISTANCE: ____________

| MAP POSITION | SAMPLE ID |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| 8 | |
| 9 | |
| 10 | |
| 11 | |
| 12 | |
| 13 | |
| 14 | |
| 15 | |
| 16 | |
| 17 | |
| 18 | |
| 19 | |
| 20 | |
| 21 | |
| 22 | |
| 23 | |
| 24 | |
| 25 | |
| 26 | |
| 27 | |
| 28 | |
| 29 | |
| 30 | |

DCN ____

| INDEX | MAP LOCATION | SAMPLE CLASS | SAMPLE ID | SAMPLE TYPE | |
|---|---|---|---|---|---|
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | | |
| 6 | | | | | |
| 7 | | | | | |
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| 23 | | | | | |
| 24 | | | | | |
| 25 | | | | | |
| 26 | | | | | |
| 27 | | | | | |
| 28 | | | | | |
| 29 | | | | | |
| 30 | | | | | ORIGINAL SAMPLE ID |
| 31 | | | | | |
| 32 | | | | | |
| 33 | | | | | |

**Samples Collected by:** ______________________ ____________

**Signature** **Date**

**Logbook Page Reviewed by:** ______________________ ____________

**Signature** **Date**

Figure 3-12: Sample Chain of Custody Record

MORRISON KNUDSEN CORPORATION

# CHAIN OF CUSTODY RECORD

720 Park Blvd., P.O. Box 73
Boise, Idaho 83729
(208) 386-5000

| Project No.: | Project Name: | | | | Split Samples | | Analysis Required | |
|---|---|---|---|---|---|---|---|---|
| Samplers: (Signature)<br>Sampler: (Print) | | | | | | | | |
| Sample Type | Sampling Point Description | Sample Date | Time | Sample I.D. Number | Yes | No | | Remarks |
| | | | | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Relinquished By: (Signature)<br>Company: | Date/Time | Received By: (Signature)<br>Company: | Relinquished By: (Signature)<br>Company: | Date/Time | Received By: (Signature)<br>Company: |
| Relinquished By: (Signature)<br>Company: | Date/Time | Received By: (Signature)<br>Company: | Relinquished By: (Signature)<br>Company: | Date/Time | Received By: (Signature)<br>Company: |
| Relinquished By: (Signature)<br>Company: | Date/Time | Received By: (Signature)<br>Company: | Received for Laboratory By: (Signature)<br>Company: | Date/Time | Total No. Samples This Shipping Container:<br>Company: |
| Relinquished By: (Signature)<br>Company: | Date/Time | Received By: (Signature)<br>Company: | Relinquished By: (Signature)<br>Company: | Date/Time | Received By: (Signature)<br>Company: |